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WISCONSIN
MICHIGAN
ILLINOIS
INDIANA

Fourth Session
September 19-21, 1972
Chicago, Illinois

CONFERENCE

Pollution of Lake Michigan and its Tributary Basin, Illinois, Indiana, Michigan, and Wisconsin

U.S. ENVIRONMENTAL PROTECTION AGENCY

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FOURTH SESSION OF THE CONFERENCE
IN THE MATTER OF POLLUTION OF LAKE MICHIGAN
AND ITS TRIBUTARY BASIN
IN THE STATES OF
WISCONSIN, ILLINOIS, INDIANA, AND MICHIGAN

VOLUME III

(Part 2 of 3 Parts)

Bal Tabarin Room
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Chicago, Illinois
September 21, 1972

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STATEMENT OF YATES M. BARBER, JR.,
FISH AND WILDLIFE ADMINISTRATOR,
BUREAU OF SPORT FISHERIES AND WILDLIFE,
U.S. DEPARTMENT OF THE INTERIOR,
WASHINGTON, D. C.

MR. BARBER: Mr. Chairman, conferees, ladies and gentlemen. My name is Yates M. Barber. I am Fish and Wildlife Administrator in the Office of Environmental Quality, Bureau of Sport Fisheries and Wildlife, U.S. Department of the Interior, Washington, D.C.

Two years ago, here in this same building, at the Workshop Session of the Lake Michigan Enforcement Conference, I presented a statement which summarized a paper entitled "Physical and Ecological Effects of Waste Heat on Lake Michigan."

Let me interrupt here, gentlemen. I do not have copies of the statement which I am reading from for you. They are a summary -- the bulk of my statement is a summary of this report which I have just had distributed to you.

MR. MAYO: Excuse me, Mr. Barber. Do you want the report you have distributed entered into the record as if read?

MR. BARBER: Yes, sir, I do.

(The document previously referred to follows in its entirety.)

Statement by
Yates M. Barber, Jr.
Fish and Wildlife Administrator
Office of Environmental Quality
Bureau of Sport Fisheries and Wildlife
U. S. Department of the Interior
Washington, D. C.

Mr. Chairman, Conferees, Ladies, and Gentlemen:

Two years ago, here in this same building, at the Work Shop Session of the Lake Michigan Enforcement Conference, I presented a statement which summarized a paper entitled "Physical and Ecological Effects of Waste Heat on Lake Michigan." That paper, prepared jointly by the Bureau of Sport Fisheries and Wildlife and the Federal Water Quality Administration, set forth the basis of our concern for the effects of waste heat discharges on the aquatic resources of Lake Michigan.

At the Chicago Workshop, most of the talk pertained to discharge effects. Since then much has been learned and it is quite obvious now that power plants with once through cooling can be as deadly at one end as the other.

The problems of entrainment and impingement of organisms in the intake flow are fully as great, and as serious, as the discharge effects of the heated water in most cases.

As presented before the Fourth Session of the Lake Michigan Enforcement Conference, Sherman House, Chicago, Illinois, September 19-21, 1972.

During 1971, the Bureau of Sport Fisheries and Wildlife presented testimony at State Hearings for Thermal Standards in Michigan, Wisconsin and Indiana.

In those statements we tabulated twelve potential adverse impacts on aquatic resources. These were:

1. Eutrophication effects over an area warmed by the plume, including increased growth of algae with a shift toward less desirable green and blue-green species.
2. Damage or destruction of zooplankton, phytophankton, fish eggs, and larval fishes entrained in the cooling water from heat, abrasive action, and turbulence in passing through the system and where chemical cleaning is used, from too frequent or excessive use of chemicals.
3. Interference with fish movements along shore zones from thermal barriers.
4. Disruption of the normal inshore temperature structures of the lake.
5. Kill of fishes in or near the plumes from thermal shock caused by sudden natural overturns of the lake or sudden cessation of heat discharges due to shutdown of the plant.
6. Predation on some species of fish (particularly the young) may be increased where fish are stunned or their responses are dulled by thermal shock or reverse thermal shock.

7. Failure of sex products to develop in adult fish resident in or near a plume, or failure of ripe adults to spawn where drawn to a plume.
8. Destruction or damage to fish eggs or larvae on the lake bottom from winter plume movements or from plumes impacting the bottom in spawning sites.
9. Early spawning of fish or hatching of fish or other organisms which may not find normal "in-phase" food supplies available.
10. Fish may be barred from use of favored shore zones by excessive temperatures at some seasons.
11. Synergistic effects with other pollutants may occur, including increased toxicity of pesticides or other toxics to fish and other aquatic life.
12. Disease incidence may be increased for salmon exposed to warmer waters.

We can now enlarge this list of possible, and probable, effects by several additional points.

First we would expand item twelve of that list to include disease impacts on fish other than just salmon.

Other impacts would include:

13. Disease in zooplankton organisms.
14. Increased uptake of pesticides and heavy metals by organisms at higher temperatures.

15. Increased release of phosphorous from bottom sediments under anaerobic conditions at higher temperatures. (Presently this might have application only in southern Green Bay.)
16. Impingement of fishes on intake screens.
17. Kill of benthic organisms by chlorine or other biocides contained in sinking plumes which flow along the bottom in winter.
18. Loss of weight by fish resident in heated plumes in winter.

Our concern for the effects of once through cooling on the natural resources of Lake Michigan has not been lessened by the course of events of the last two years. During that time there has been some research, though not nearly enough, plus many surveys and observations concerning the effects of power plants on living aquatic resources. Some of this work pertained particularly to Lake Michigan, other was conducted at various points across the country, where the concern for effects of power plants on aquatic resources is just as great as it is here.

In total, the accumulation of evidence as to the adverse impact of once through cooling is impressive. A review of some of the observations and findings to date leads us inevitably to a reaffirmation of our belief that large thermal power plants using once through cooling are incompatible with the management of the living aquatic resources, and especially the fishery resources, of Lake Michigan for the public good.

I would like today to run through a list of research findings and of power plant incidents which we feel will substantiate our concern for the effects of plants with once through cooling on living aquatic resources.

Most of these data are new to this conference, although not all of them are. In many cases you may be well aware of the incidents but will realize that it has not been entered in the conference proceedings.

This list is by no means complete. We did not include many incidents or research findings of which we knew but did not have time to obtain the publication, or to contact the worker, or to obtain confirmation of the incident.

We have included a number of newspaper reports of fish kills, mainly because this seems to be the only public record in many cases. We are led to believe that most fish kills at power plants in the past have gone unrecorded in the public record. Time did not permit our verification of the details of all the newspaper reports since we began work on this list quite recently.

The question of exactly how many fish were killed or even how they were killed may be of less concern at the moment than the fact that a kill did occur at a power plant.

The list of power plant effects is taken from a summary of information prepared recently by the Great Lakes Fishery Laboratory of the Bureau of Sport Fisheries and Wildlife at Ann Arbor, Michigan.

I offer for the record a copy of this summary entitled "Review of Recent Technical Information Concerning Waste Heat Discharges Into Lake Michigan."

The paper is now undergoing a final editing and will be issued soon by the Ann Arbor Laboratory. I offer it for the record here, in its present draft form because it contains the bibliographic references for the list I am about to cite.

This list has been divided into intake effects and discharge effects.

One of the serious effects of plant intakes with large withdrawals of water is the impingement of fish on the intake screens. Most such screens are movable and have a mesh of about 3/8". Thus impinged fish are usually about 2" or more in length. Virtually all fish so entrapped are killed. The problem is a widespread one and is of major concern.

State Fish and Wildlife biologists in California estimate kills of 4 to 25 tons each month at plants sited along 200 miles of the California coast between Ventura and San Diego.

One of the best documented records is that at the Indian Point generating station on the Hudson River in New York. It has been estimated that several million fish have been killed at this 285 MW plant in recent years. Kills occurred as early as 1963 and apparently each year since.

Between November 6, 1969 and January 11, 1970, 1,310,345 fish were killed on the intakes at Indian Point. Most were white perch but more than 10% were striped bass.

A preliminary test of just two of the six pumps needed for Indian Point Number Two, killed 75,000 fish on the intake screens in a few days of operation in January 1971.

In February 1972, when two pumps were again tested, one of them at but half of capacity, about 150,000 to 175,000 fish were killed on the intake screens in four days of operation.

It has been estimated that about 60% of the fish killed at Indian Point were white perch. Twenty-three species were represented in the total kill.

The AEC concluded that operations of Indian Point Units 1 and 2 would likely result in a loss of a significant portion of the striped bass population of the Hudson River and would also effect the fisheries of New Jersey and Long Island coasts.

A heavy kill of young herring over a 9 day period was reported at Glenwood Landing, New York in December 1952.

An estimated 2 million young menhaden were reported lost in August and November 1971 at Waterford, Connecticut on Long Island Sound.

Records of kills on intake screens on the Great Lakes are difficult to locate but we have included a number of such incidents.

In December 1970, a fish kill occurred at a generating plant on Saginaw Bay on Lake Huron. The duration of the kill was unknown, but 4,760 distressed and dead fish were reported as observed on one day and the kill for a week was estimated as several times larger. Several species of fish were involved.

Heavy kills of fish (mostly alewives) have been reported for 1963 and 1965 from the Saginaw-Midland water intakes, a municipal supply.

In 1952, some 2 to 3 tons of grizzard shad from the Detroit River were killed when they entered the intake pipe of the Parke Davis Company.

A one hour power failure was reported in 1955 as a result of gizzard shad entering the intake pipe of the Pennsylvania Electric Company plant on Lake Erie.

On April 7, 1972, at the Monroe Plant on Lake Erie, Michigan Water Resources Commission biologists weighed 1,357 pounds of fish trapped on the travelling screen. These were not all the fish killed since the collection basket overflowed. Sixty percent of the fish were perch and 13 species were listed. Apparently 300-600 pounds of fish per day were taken during each of the preceeding 3 days.

On Lake Michigan, an alewife problem at Waukegan was one of the earlier reported fish kills. A 1967 report indicates sometimes massive impingements in 1961, 1962, 1963, and 1964. In 1965 and 1966 massive jams occurred again.

Alewives were reported entering water intakes at U. S. Steel's Gary Works in 1966 and Inland Steels Indiana Harbor Works has had similar problems.

The City of Chicago's Central District water filtration plant in 1965 encountered problems with Alewives on its intake screens at an hourly rate of 30,000 pounds during peak periods. At the South Filtration plant intake annual kills ranged from 21,000 pounds in 1965 to 123,000 pounds in 1971.

Studies by the Environmental Protection Agency in November 1971 report many large lake trout were drawn into the intakes of the Big Rock Power Plant although the fate of the fish is not given.

However, conditions favorable to losses of chubs and suckers are given as are those for smelt in similar investigations at the small Escanaba Power Plant in Michigan.

A massive fish kill occurred at the Consumer Power Company's Campbell Plant on Lake Michigan in January and February 1971. Michigan Water Resources Commission personnel reported a kill of several hundred thousand fish. The kill had been going on for 7 to 10 days before it was reported to the Commission on February 4th. Most of the dead fish were gizzard shad, but alewives and perch were included. Of special interest in this case is the proof that massive fish kills in winter are not conspicuous. The several hundred thousand dead fish from the screens had been discharged into the outlet canal where they were washed out into the lake. Yet, on February 4th after 7 to 10 days of such kill and discharge to the lake, the dead fish were not visible in the 10 to 20 acres of ice-free open water around the mouth of the discharge canal. Observations of fish under study in the laboratory, suggest that fish freshly killed at power plants in winter may sink to the bottom, perhaps due to contraction of the swim bladder upon entrainment with colder water.

One of the latest pieces of evidence on impingement of fishes on Lake Michigan was presented at the National Conference of the American Fishery Society on September 11 by Dr. Robert Benda.

He reported that 51,235 fish weighing 4,995 pounds have been taken from the screens of the Palisades Power Plant between May 16 and August 25, 1972. These fish include 17 species. While the Alewives were about 60% by number and 44% by weight the yellow perch with 8,608 fish were about 16% by number and 40% by weight. Trout and salmon totalled only 28 fish but included one 13 pound chinook salmon. Bloater, smelt, shiners, and sculpin were included in good numbers. The large catch of 7,343 sculpins in early June suggests opportunity for extremely heavy annual losses of this fish since it is usually most abundant in the 18 to 30 foot depths in winter and early spring.

Argonne has reported the principal mortality at Palisades in January and February to be Sculpins. Dr. Benda stated that the intake velocities at Palisades were only about 3/4 ft. per second or less.

I would point out that the intake velocities of the Palisades plant which amounts to only about 1000 cfs appears to be one of the more favorably designed intakes of the large plants under construction on the Lake.

By contrast, at the Zion Plant the intake velocities of up to 2.47 ft. per second during non-winter operations (and up to 3.7 ft. per second during winter operations) with a gross volume of up to about 3400 cfs flow presents a very real potential for significant fish losses, as do many of the other plants.

Information from the Great Lakes Fishery Laboratory indicates high populations of several species of fish in the beach water zone (at depths less than 30 ft. deep) where most of the intakes are located.

Wells has shown that peak abundance of bloaters, smelt, trout - perch, and adult yellow perch occurs in 18-30 ft. of water in summer in southeastern Lake Michigan. Slimy sculpins occur there in February through mid-April, adult alewives show peak abundance in April through June, and young-of-the year alewives in October and November.

Data for other species is less well documented but available data indicate that burbot, lake herring, lake whitefish, and most of the trout and salmon species can be expected to be abundant in the 18 to 30 ft. depths in the fall.

Exploratory fishing by the Great Lakes Fishery Laboratory research vessels in November and December 1971 showed spawning lake trout to be abundant near the intakes of both the Palisades and the Donald C. Cook Generating Stations.

A second major loss of fish can occur from the entrainment of non-screenable fish with the intake water. These are considered to include fish eggs and any fish small enough to go through a 3/8" screen. Obviously all larval and fry fish can go through the plant as can young fish up to about two inches for most species. Apparently few of these fish survive the physical battering, the pressure changes, and thermal shocks of this trip over the condensers, and many which do expire to long exposure to excess temperature or fall prey to predators as they emerge in the plume in a dazed condition.

Fish eggs sometimes simply disappear on passage through a plant, perhaps due to rupture. Loss of up to 99.7% of striped bass eggs has been recorded at a generating station at Vienna, Maryland, apparently through disintegration.

Sampling of fish and larvae at the Chalk Point, Maryland generating station revealed mortality of 92.4% on passage through the plant.

At the Haddam Neck, Connecticut Nuclear Plant, 100% mortality of entrained young fish of 9 species was found when temperatures exceeded 86°F for passage through a 1.14 mile canal. These fish were alewives and a close relative, the glut herring. The investigator found also that 65% of larvae were killed when exposed for only 93 seconds to a 10.7°F increase to 82.7°. 83% were killed in 93 seconds when exposed to 92.3°F temperatures.

At the Brayton Point plant at Mount Hope Bay, Rhode Island a heavy kill of manhaden fry was recently documented by the Environmental Protection Agency. Some flounder were also killed.

164,000,000 manhaden larvae were killed in passage through this plant in 24-hours on July 2, 1971. Subsequent sampling indicated that the kill continued through July and well into August with a minimum observed 24-hour kill of 7 million fry in August.

There are few data on fish eggs, or fry passing through the plants on the Great Lakes. Some sampling was conducted at the Point Beach Station and at the Oak Creek Station by the State of Wisconsin from March 3 to May 27, 1971 and March 22 to April 22, 1971 respectively.

At Point Beach plankton nets fished on 14 days produced a catch of one sculpin each on eight days and a few smelt eggs on another two days and an unidentified fish egg on another.

The volume of water measured was 5/1000ths of one percent of the total volume of flow. Extrapolation of the test results would suggest that around 4 million sculpins may have gone through the plant during 42 days of operation between March 3 and April 29. Between April 29 and May 19, about 23/1000ths of the water was sampled. Assuming a few smelt eggs to mean 10, then the number passing through the plant may have been on the order of 400,000 in 24-hours on May 4 and more than one million on May 5.

The Oak Creek entrainment studies show that in 17 days of fishing, smelt eggs in quantities from few to numerous were taken on five days and smelt in size from fry to adult were taken on 7 days and 1 alewife was taken on another.

The number of these organisms in the intake water as compared to the discharge is not known nor is the percent survival of any of these organisms after passage through the plant. In any case, the fact that a minimal sampling took both fish and eggs consistently at these plants suggests a high probability of entrainment and destruction of large numbers of fish and eggs at both plants.

Studies of distribution of fish fry along the eastern shore of Lake Michigan were made by the Great Lakes Fishery Laboratory in spring and summer of 1972.

Samples were taken at surface to 4 meter depths and the densities of fry for 3 species were determined. These were alewives, smelt and yellow perch.

Based on these samples only, and assuming that the water is withdrawn from the 3 to 4 meter depth and assuming equal distribution of larvae throughout the entire volume of cooling water, we estimate that entrainment of fry could be as high as 5 million alewives, 100,000 perch fry and 170,000 smelt per day at the Donald C. Cook plant at the periods when highest densities were sampled.

At the Palisades plant under the same assumptions entrainment of fry could be as high as 1/2 million alewives, 150,000 perch and 60,000 smelt, based on the Bureau of Sport Fisheries and Wildlife data.

I emphasize that we have no reason to believe that we necessarily sampled at the peak density of any of these species so how high the entrainment might be under some particular set of circumstances at a given time is not quantifiable. It could be lower but it is also possible that it could be many times higher, expecially if water from the top 3 meters of depth was entrained. Fry densities were much higher for perch and alewives nearer the surface.

In work by Dr. Benda at the Palisades Plant plankton sampling of 3.4 million gallons of water in 300 hours resulted in a catch of less than 1000 fish eggs and 5 larvae. At the pumping rate of 405,000 gallons per minute this indicates possible passage of 20 million eggs and 1,000 larvae during the 300 hours of sampling. Expansion of these data to cover the full period of May 16 to August 25 suggests massive losses of eggs and larvae may occur at the Palisade site. We recognize that a direct extrapolation of Dr. Benda's data may not be appropriate but it does give some idea of the relationships of the figures involved.

The potential loss of whitefish larvae is of great concern to the Fish and Wildlife Service. The whitefish population of the southernmost end of the Lake is probably at its all time low but limited sampling at Saugatuck suggests a potential comeback of these populations. Populations in the northern Lake still support commercial and sport fisheries.

Newly hatched whitefish are at the surface in very shallow water in early spring but as temperatures approach 68°F they move off to deeper and slightly cooler water. 62.6°F is the temperature at which the bulk of population has been reported in Lake Huron. The fish are found where the 62.6°F isotherm touches bottom. In Lake Huron this moves off shore between July and mid-September when it reaches a 67-foot depth.

In Lake Michigan 62.6°F water would be available from mid-June or early July to mid-September or early October depending on the year.

All Lake Michigan once through cooling water intakes are within the zone that the 62.6°F isotherm would pass outward through and beyond.

Recently completed studies of temperature tolerance of whitefish fry at the Great Lakes Fishery Laboratory indicate that the temperature increases and time of exposures to be caused by the Palisades and Zion Plants coincide almost exactly with the temperature and time exposures that cause 50% mortality from thermal shock alone in whitefish fry acclimated to 62.7°F.

At the Kewaunee plant the 20°F increase and 2.2 to 4.7 minutes exposure time will also cause 50% mortality from heat alone when intake temperatures are at about 62.7°F.

Whitefish fry not killed by elevated temperatures, mechanical mauling by screens, pumps and cooling system or by chlorination will likely be more susceptible to capture by predators concentrated in or near the plumes. This is explained more fully later.

Concentration of fishes by heated effluents has been recognized for some time. This results from temperature but also from currents or availability of crippled food organisms. Fish and other organisms can be attracted by warmer water at times, as in winter and repelled at other times as in summer when preferred or tolerance limits of a species are exceeded.

Several observations on Lake Michigan confirm these points:
In summer elevated temperatures tend to attract some species of warmwater fish as carp, alewives, smallmouth bass, spottail shiners, perch and gizzard shad, while repelling trout, salmon and other coldwater species.

When effluent temperatures are below about 65°F both warm and coldwater species may be attracted.

Concentration of these fish at the plumes where fishermen can harvest them is often touted as a great benefit brought about by once through cooling.

Perhaps it is but there are several negative aspects which should not be ignored.

Heavy mortality can result to these concentrated fishes from sudden sharp increases in temperature where fish are confined in a small area, as in a discharge canal. Such a kill of 1,000 game fish (mostly striped bass 10-14 inches in length) on June 7, 1971 has been reported from Tompkins Cove, New York, when condenser cooling water temperatures were sharply increased.

Of special interest are the results of studies which show a major weight loss by fishes overwintering in a plume. At Haddam Neck on the Connecticut River studies of tagged fish (brown bullhead and white catfish) showed an average loss of body weight in 4 months of 20% for fish wintering in the plume. Some individuals lost as much as 60% of body weight. Poor condition was noted for some individuals of these species in the canal during summer.

Of greater relevance is the sudden interruption of heat input during winter.

A number of low temperature kills in marine waters are known. One recent case was a massive kill at Oyster Creek on Barnegat Bay, New Jersey. A drop of 22°F from 59°F to 37°F, during an operational shutdown resulted in a kill of menhaden, anchovies, bluefish, striped bass and herring.

A conspicuous freshwater kill occurred in February 1971 on the Susquehannah River when a leak in a plant at York Haven, Pennsylvania forced a sudden shutdown. Temperatures dropped from a high of around 72°F to about 38°F within one hour. A tally of dead fish three days after the sudden outage was about 15,000 game fish. Fish smaller than 5 or 6 inches and certain rough fish were not tallied. The incidence of dead fish which did not float or were not otherwise visible is unknown.

Two kills were recorded at Fremont, Ohio on the Sandusky River, tributary to Lake Erie in January 1967 and in the winter of 1968. I do not have details of these kills.

The records of kills due to winter shutdown at electric plants on Lake Michigan are slow to appear. However, I suggest that this deserves special investigation and close observation of plants during winter shutdown.

Numerous shutdowns without effect are claimed, but assurance that close examinations were made at that time would be most reassuring. The difficulty of detecting kills is evident. The incident of huge numbers of dead fish discharged to the lake at the Campbell plant without any being visible in a 10-20 acre area of open water is a case in point. Laboratory evidence that recently dead fish moving from hot to cold water will sink is important as is the short period of daylight, poor observing conditions and ice cover, during Lake Michigan winters. The ability of predators and scavengers to remove a large number of dead fish from the surface in a short time is also important.

The likelihood of kills when sudden outage of plants occurs on Lake Michigan seems high if we examine known lethal temperatures for some Lake Michigan fishes. Data indicate that 50% kill might be expected as follows:

Coho Salmon acclimated to 41°F are killed by a sudden drop of 8°F.

Chinook Salmon and Ciscoes acclimated to 43°F would be killed by an 11°F decrease.

Grizzard shad acclimated to about 50°F would die from an 18°F temperature drop.

Emerald shiners acclimated to about 54°F will die following a sudden 22°F drop.

White Suckers acclimated to 62°F would be killed by a drop of about 30°F.

Available data for Brooktrout and Sculpin suggest they might not be effected by a sudden drop.

However, we lack specific data for several important species. It is probable that such fish as whitefish, brown and rainbow trout, spottail shiners, smelt, and alewives have temperature change tolerances no greater than those listed above.

A review of the temperature rise at some 20 plants on the Lake (existing and under construction) suggests that a sudden outage in winter could cause a fish kill if any of several species of fish were in the plume and were acclimated to warmed water of the plume.

Another source of damage to fish populations from the discharge of power plants is from entrainment of fish fry and other weak swimming organisms into the plume.

High velocity jet discharges are dependent on quick entrainment and mixing with the cooler receiving water.

Research at the Great Lakes Fishery Laboratory has shown that thermal shock increases the vulnerability of whitefish fry to predation. Fry acclimated to 64.4°F (their preferred temperature is 62.6°F) and given a 1 minute shock exposure at 84.2°F are significantly more susceptible to predation. The time of 1 minute exposure to this 20°F increase could occur in the mixing jet of the Zion plant and probably others as well.

The increase in predation from shock may be one of the more significant impacts of the waste heat discharge. This shock may not only result from temperature but also from physical damage during passage through a plant's cooling system or while entrained or from sub-lethal doses of biocides. Weak swimmers which are entrained may simply be displaced by being buoyed to the surface in the warmest part of a floating plume where chance of attack by predators is increased.

Combinations of thermal, chemical, and mechanical impacts probably would be additive and vulnerability would increase where one or more impacts coincides with another.

Effects of sinking plumes on incubating fish eggs may be especially important. Of interest is that the sinking plume does not appear to have been recognized as existing in Lake Michigan until the questions were raised in discussions with Argonne Laboratory technicians during a working session of the Lake Michigan Enforcement Conference Technical Committee during the fall of 1970.

Research by Argonne has proven the existence of the plumes and that even modest sized thermal plants can cause bottom plumes of as much as 2.6°C over ambient at a distance of 1525 meters from the discharge and a difference of 4.0°C at closer ranges.

Sudden changes of up to about 4°C in bottom temperatures were recorded at some locations. Argonne concluded that hatching of lake herring eggs could be advanced 7 days by the higher temperatures caused by the sinking plumes. Possible stimulation of periphyton growth by higher temperatures was also recognized.

Recent research at the Great Lakes Fishery Laboratory on the effects of temperature on the incubation and hatching of the eggs of whitefish has shown a 136 day incubation period under simulated normal lake conditions.

Increase of temperatures by 1.8, 3.6, and 7.2°F every 4th day during the full incubation period shortened the incubation to 138, 134, and 125 days respectively.

Constant addition of 1.8, 3.6, and 7.2°F over natural temperatures resulted in hatching at 128, 115, and 86 days respectively.

A discussion of the shortening of the incubation of whitefish eggs is included in Appendix A of the Palisades Environmental Impact Statement. This indicates a shortening of even 13 days would significantly reduce the production of whitefish fry and the abundance of whitefish for sometime thereafter.

Another item of concern is the effect of temperature on attainment of sexual maturity and egg viability of fishes.

Research at the National Water Quality Laboratory of EPA at Duluth has shown that yellow perch achieved optimum gametogenesis and spawning when exposed to 4°C for a period of 185-200 days. Large deviation from these values reduced fecundity in terms of production of viable eggs, number of females spawning and the quality of the spawn. Deviations from the optimum 185 days at 4°C may affect males and cause a greater proportion of unfertilized spawnings.

Perch were among the fish killed at the Campbell plant and this suggests that they are attracted from the 4°C water where their fecundity may be affected by higher temperatures.

An inconspicuous but possibly significant effect of increased temperature on fish is in the increased incidence of disease in fish at higher temperatures.

A review of the literature shows clearly that elevated temperature plays a vital role in incidence and severity of infection. It has been demonstrated that higher temperatures drastically increased the effects of kidney disease, furunculosis, vibro disease and columnaris in young salmonids.

The effects of temperature and disease is documented for a major kill of perch in Chesapeake Bay, for an incidence of columnaris disease in the Columbia River and in the near obliteration of the sockeye salmon in the Columbia River in 1941.

There already are serious problems with fungal infections, perhaps in concert with other diseases, in male brown trout along the Wisconsin shore when the fish enter warmer shore waters to spawn. Mortalities of 88% in 1968 and nearly 100% in 1970 were recorded for male brown trout.

Heavy fungus, perhaps coincident with bacterial infection, has been noted on spawning browns and rainbows which enter Michigan streams to spawn.

Kidney lesions have been reported in Lake Michigan coho salmon and dead salmon with kidney lesions have been recovered from the Lake. In 1970 kidney disease was reported from 1.83% of 273 cohos examined.

Concentration of fishes in plumes may offer opportunity for spread of disease from fish more severely infected because of their presence in warm water.

The uptake of some pollutants by fish appears to be higher at higher water temperatures.

Recent research at the Great Lakes Fishery Laboratory has shown that lake trout exposed to 0.20 ppb methylmercury accumulated almost twice as much from water at 10°C as from water at 5°C.

Rainbow trout exposed to similar concentrations for eight weeks in water at 5, 10, and 15°C accumulated 50% and 100% more at the higher temperatures than at 5°C.

Temperature may effect the uptake of other pollutants by fish. It has been shown that a correlation exists between respiration and uptake of DDT by the mosquito fish. Though Gambusia are not Lake Michigan fish, this finding suggests a relationship between temperature and DDT uptake which cannot be ignored in view of the high levels of DDT and PCB now occurring in some Lake Michigan fishes.

It is an established fact that some toxicants are more lethal to fish at higher temperatures than at lower temperatures. It has been suggested that some chemicals used in power plants may also be more toxic at higher temperatures.

A matter of concern is the effect of temperature on higher nutrient release from bottom sediments under anaerobic conditions. Recent research at the Ann Arbor Fishery Laboratory has confirmed that phosphorous is released at a rate four times greater at 77°F than at 44°F.

Much has been said about planktonic algae in Lake Michigan but we still know far too little about the effects of temperature on this primary element of the aquatic biota.

A 1969 report indicates that within some temperature ranges (68°F or cooler) a higher temperature stimulated photothensis but above 68°F further increases inhibited it. At high ambient temperatures, a permanent inhibition of photosynthenis occurred for phytoplankton that had passed through the power plant. During chlorination all phytoplankton passing through the plant were killed.

A study at Turkey Point, Florida indicated a decrease in species diversity with temperatures of 9°F above intake and blue-green algae increased when ambient temperatures were 78.8 to 82.4°F.

Other workers have found that increased temperature from a power plant on the Delaware River resulted in a decrease in the total number of phytophankton species but an increase in bluegreen algae species.

In the Susquehannah River, heated water reduced the number of species of algae.

However, the effects of heated plumes on the productivity of planktonic algae relative to suppression of desirable species and blooms of undesirable forms has not been clearly established.

The movement of discrete water masses with each carrying its own assemblage of planktonic forms through the sample area results in complications of the study. Most discharge sites are potentially productive areas because of nutrients released by organism killed on passage through the plant.

Entrained algae carried to the surface in the nutrient rich, buoyant plumes would appear to be favorable to increased growth.

Chlorination may debilitate many of the algal species and selectively effect the production of desirable or undesirable species.

These considerations viewed with respect to evidence of periphyton production, to be discussed next, suggest that net increases may be occurring among populations of planktonic algae in heated plumes in Lake Michigan.

The periphyton communities seem to differ from the planktonic algae communities in that they seem to be responding to heated effluents in a predictable manner.

Connecticut River investigations showed similarity of planktonic communities above and below a heated discharge. Among the periphyton, however, diatoms dominated samplers above the discharge and blue-greens below. One year after the plant began operation numbers of organisms in the effluent were 4.3 times as abundant as before the discharge when numbers were similar in both areas.

Studies at Point Beach in the summer of 1971 showed significantly greater biomass at near field stations than at far stations on a temperature difference of only 3.6°F. Winter stimulation of periphyton growth by sinking plumes could be of significance and should be carefully searched for.

Cleaning of condenser tubes in power plants to remove biological fouling is essential to plant maintenance and efficiency. Heat shock, chemicals and passing mechanical devices through the system have all been used.

Chemicals are generally the most serious threat to the ecology. Chlorine as hypochlorite or gaseous chlorine is probably the most widely used biocide in power plant cooling systems. Various concentrations are used and effectiveness of chloramines can be hampered by high BOD or ammonia levels.

Unfortunately, all these forms of chlorine are toxic to aquatic organisms and often at levels below those used in power plants.

During chlorination, all the planktonic organisms, including fish larvae, may be killed in the water passing through the plant while large numbers probably are affected in the plume.

Long-term exposure of rainbow trout to as little as 0.05 ppm may be toxic.

Other organisms have extremely low tolerances for chlorine on long-term exposure.

Fish kills have resulted from chlorine discharges into plume areas where fish were concentrated. This may have been a factor in a fish kill effecting the intake screens at the Waukegan power plant.

Some fish detect and avoid chlorine at concentrations as low as 0.001 ppm and several species have been observed avoiding discharges when chlorine was present. Conversely fish have been observed dying by thousands immediately after chlorination began.

If chlorination during winter drives fish out of heated areas to which they are acclimated, the possibility exists that these fish would be killed by low temperature shock.

Benthic and psammo-littoral communities may be especially hard hit by chlorine residuals in sinking plumes which flow over the bottom. The invertebrate species of these communities appear to be especially sensitive to chlorine.

Unfortunately, some power plants appear to use excessive amounts of chlorine at times, perhaps because of inadequate measurement techniques.

More studies of acute and chronic effects of chlorine are needed. Preliminary evidence indicates that sublethal doses of chloramine can cause reduction of egg production in fish and invertebrates.

Gentlemen, in the interest of time I will not summarize this long list of problems with once-through cooling at power plants. Needless to say, the draft document provided you contains an elaboration on these matters and the references for the information it contains. I commend this document to your careful consideration. I believe it provides ample proof of the significant adverse impact of once-through cooling on aquatic resources and of the necessity of closed cycle cooling for all the larger power plants on the shores of Lake Michigan.

MR. BARBER: That paper, prepared jointly by the Bureau of Sport Fisheries and Wildlife and the Federal Water Quality Administration, set forth the basis of our concern for the effects of waste heat discharges on the aquatic resources of Lake Michigan.

At the Chicago Workshop, most of the talk pertained to discharge effects. Since then much has been learned and it is quite obvious now that powerplants with once-through cooling can be as deadly at one end as the other.

The problems of entrainment and impingement of organisms in the intake flow are fully as great, and as serious, as the discharge effects of the heated water in most cases.

During 1971, the Bureau of Sport Fisheries and Wildlife presented testimony at State hearings for thermal standards in Michigan, Wisconsin and Indiana.

In those statements we tabulated twelve potential adverse impacts on aquatic resources. These were:

1. Eutrophication effects over an area warmed by the plume, including increased growth of algae with a shift toward less desirable green and blue-green species.

2. Damage or destruction of zooplankton, phytoplankton, fish eggs, and larval fishes entrained in the cooling water from heat, abrasive action, and turbulence

in passing through the system and where chemical cleaning is used, from too frequent or excessive use of chemicals.

3. Interference with fish movements along shore zones from thermal barriers.

4. Disruption of the normal inshore temperature structures of the lake.

5. Kill of fishes in or near the plumes from thermal shock caused by sudden natural overturns of the lake or sudden cessation of heat discharges due to shutdown of the plant.

6. Predation on some species of fish (particularly the young) may be increased where fish are stunned or their responses are dulled by thermal shock or reverse thermal shock.

7. Failure of sex products to develop in adult fish resident in or near a plume, or failure of ripe adults to spawn where drawn to a plume.

8. Destruction or damage to fish eggs or larvae on the lake bottom from winter plume movements or from plumes impacting the bottom in spawning sites.

9. Early spawning of fish or hatching of fish or other organisms which may not find normal "in-phase" food supplies available.

10. Fish may be barred from use of favored shore

zones by excessive temperatures at some seasons.

11. Synergistic effects with other pollutants may occur, including increased toxicity of pesticides or other toxics to fish and other aquatic life.

12. Disease incidence may be increased for salmon exposed to warmer waters.

We can now enlarge this list of possible and probable effects by several additional points.

First, we would expand Item 12 of that list to include disease impacts on fish other than just salmon.

Other impacts would include:

13. Disease in zooplankton organisms.

14. Increased uptake of pesticides and heavy metals by organisms at higher temperatures.

15. Increased release of phosphorus from bottom sediments under anaerobic conditions at higher temperatures. (Presently this would probably apply only to southern Green Bay.)

16. Impingement of fishes on intake screens.

17. Kill of benthic organisms by chlorine or other biocides contained in sinking plumes which flow along the bottom in winter.

18. Loss of weight by fish resident in heated plumes in winter.

Y. Barber

Our concern for the effects of once-through cooling on the natural resources of Lake Michigan has not been lessened by the course of events of the last 2 years. During that time there has been some research, though not nearly enough, plus many surveys and observations concerning the effects of powerplants on living aquatic resources. Some of this work pertained particularly to Lake Michigan, other was conducted at various points across the country, where the concern for effects of powerplants on aquatic resources is just as great as it is here.

In total, the accumulation of evidence as to the adverse impact of once-through cooling is impressive. A review of some of the observations and findings to date leads us inevitably to a reaffirmation of our belief that large thermal powerplants -- and I might add, after seeing the data of the last witness and other large thermal dischargers -- using once-through cooling are incompatible with the management of the living aquatic resources, and especially the fishery resources, of Lake Michigan for the public good.

I would like today to run through a list of research findings and of powerplant incidents which we feel will substantiate our concern for the effects of plants with once-through cooling on living aquatic resources.

Most of these data are new to this conference, although not all of them are. In many cases you may be well aware of the incidents, but will realize that it has not been entered in the conference proceedings in the past.

MR. McDONALD: Mr. Barber.

MR. BARBER: Yes.

MR. McDONALD: I wonder if, as you run through these, you would identify those that are new to the conference.*

MR. BARBER: If I can, sir. I may not be fully aware of the total record of the conference in the past, but many of these are incidences of fish kills, many of which are not necessarily in the Great Lakes, but I think that if I could not do it at this moment, I could do it for the record insofar as my knowledge of the conference record goes.

MR. McDONALD: Very good.

MR. BARBER: This list is by no means complete. We did not include many incidents or research findings of which we knew but did not have time to obtain the publication, or to contact the worker, or to obtain the confirmation of the incident.

We have included a number of newspaper reports of fish kills, mainly because this seems to be the only public record in many cases. We are led to believe that most fish

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*(See following page.)

ADDRESS ONLY THE DIRECTOR,
BUREAU OF SPORT FISHERIES
AND WILDLIFE

United States Department of the Interior
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
WASHINGTON, D.C. 20240

OCT 2 6 1972

Mr. Francis T. Mayo, Chairman
Lake Michigan Enforcement Conference
U.S. Environmental Protection Agency
One North Wacker Drive
Chicago, Illinois 60606

Dear Mr. Mayo:

When I testified at the 4th session of the Lake Michigan Enforcement Conference in Chicago on September 21, 1972, the Federal Conferee, Mr. James McDonald, asked whether the information presented in my statement was new to the Lake Michigan Enforcement Conference.

I have not reviewed all the proceedings of the earlier sessions of the Conference but I have examined several documents pertaining to sessions dealing with thermal pollution. I have also reviewed my files on the Lake Michigan Technical Committee in which I participated.

Some of the predicted impacts on aquatic life which I discussed were recognized in the earlier sessions of the Conference, of course. However, in so far as I can determine the confirming evidence of known instances of damage from once-through cooling, and the research findings supporting the various predictions of impacts were not reported in the proceedings of previous sessions of the Conference.

This would hold true both for my statement and for the draft document, "Review of Recent Technical Information Concerning Waste Heat Discharges into Lake Michigan", which I presented for the record.

Yours very truly,

Yates M. Barber

Yates M. Barber
Fish and Wildlife Administrator
Office of Environmental Quality

kills at powerplants in the past have gone unrecorded in the public record. Time did not permit our verification of the details of all the newspaper reports since we began work on this list quite recently.

The question of exactly how many fish were killed or even how they were killed may be of less concern at the moment than the fact that a kill did occur at a powerplant.

I think we would not question in the case of those clippings which we have used that there was an incident which occurred although the details might justify verification.

The list of powerplant effects is taken from a summary of information prepared recently by the Great Lakes Fishery Laboratory of the Bureau of Sport Fisheries and Wildlife at Ann Arbor, Michigan.

I offer for the record a copy of this summary entitled "Review of Recent Technical Information Concerning Waste Heat Discharges into Lake Michigan." This is the green-covered document which I gave you.

The paper is now undergoing a final editing and will be issued soon by the Ann Arbor Laboratory. I offer it for the record here, in its present draft form, because it contains the bibliographic references for the list I am about to cite.

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(The document previously referred to is on file at U.S. EPA, Headquarters, Washington, D.C.; and EPA, Region V Office, Chicago, Illinois.)

This list has been divided into intake effects and discharge effects.

One of the serious effects of plant intakes with large withdrawals of water is the impingement of fish on the intake screens. Most such screens are movable and have a mesh of about 3/8". Thus, impinged fish are usually about 2" or more in length. Virtually all fish so entrapped are killed. The problem is a widespread one and is of major concern.

State Fish and Wildlife biologists in California estimate kills of 4 to 25 tons each month at plants sited along some 200 miles of the California coast between Ventura and San Diego.

One of the best documented records of fish kills by impingement is that at the Indian Point generating station on the Hudson River in New York. It has been estimated that several million fish have been killed at this 285 MW plant in recent years. Kills occurred as early as 1963 and apparently each year since.

Between November 6, 1969, and January 11, 1970, 1,310,345 fish were killed on the intakes at Indian Point.

Most were white perch but more than 10 percent were striped bass.

A preliminary test of just two of the six pumps needed for Indian Point No. 2, located at the same site, killed 75,000 fish on the intake screens in a few days of operation in January 1971.

In February 1972, when two pumps were again tested, one of them at but half of capacity, about 150,000 to 175,000 fish -- according to which agency's estimate you use -- were killed on the intake screens in 4 days of operation.

It has been estimated that about 60 percent of the fish killed at Indian Point were white perch. Twenty-three species were represented in the total kill.

The AEC concluded that operations of Indian Point Units 1 and 2 would likely result in a loss of a significant portion of the striped bass population of the Hudson River and would also affect the fisheries of the New Jersey and Long Island coasts.

Another incident of importance is a heavy kill of young herring over a 9-day period reported at Glenwood Landing, New York in December 1952.

An estimated 2 million young menhaden were reported lost in August and November 1971 at Waterford, Connecticut on Long Island Sound.

Records of kills on intake screens on the Great Lakes are difficult to locate but we have included a number of such incidents.

In December 1970, a fish kill occurred at a generating plant on Saginaw Bay on Lake Huron. The duration of the kill was unknown, but 4,760 distressed and dead fish were reported as observed in one day and the kill for a week was estimated as several times larger. Several species of fish were involved.

Heavy kills of fish (mostly alewives) have been reported for 1963 and 1965 from the Saginaw-Midland water intakes, a municipal supply.

In 1952, some 2 to 3 tons of gizzard shad from the Detroit River were killed when they entered the intake pipe of the Parke Davis Company.

A 1-hour power failure was reported in 1955 as a result of gizzard shad entering the intake pipe of the Pennsylvania Electric Company plant on Lake Erie.

On April 7, 1972, 60,000 emerald shiners were killed in the intake of a generating plant in Erie Harbor, Pennsylvania.

On April 7, 1972, at the Monroe plant on Lake Erie, Michigan Water Resources Commission biologists weighed 1,357 pounds of fish trapped on the traveling screen. These were not all of the fish killed since the collection basket overflowed. Sixty percent of the fish were perch and 13 species were listed. Apparently 300 to 600 pounds of fish per day were taken during each of the preceding 3 days.

On Lake Michigan, an alewife problem at Waukegan was one of the earlier reported fish kills. A 1967 report indicates sometimes massive impingements in 1961, 1962, 1963, and 1964. In 1965 and 1966 massive jams occurred again.

Alewives were reported entering water intakes at U.S. Steel's Gary Works in 1966, and Inland Steel's Indiana Harbor Works has had similar problems.

The city of Chicago's Central District water filtration plant in 1965 encountered problems with alewives on its intake screens at an hourly rate of 30,000 pounds during peak periods. At the South filtration plant intakes in Chicago, annual kills ranged from 21,000 pounds in 1965 to 123,000 pounds in 1971.

Studies by the Environmental Protection Agency in November 1971 report many large lake trout were drawn into the intakes of the Big Rock powerplant although the fate of the fish is not given. However, conditions favorable to losses of chubs and suckers were given, as are those for smelt in similar investigations at the small Escanaba powerplant in Michigan.

A massive fish kill occurred at the Consumer Power Company's Campbell plant on Lake Michigan in January and February 1971. Michigan Water Resources Commission personnel reported a kill of several hundred thousand fish. The kill had been going on for 7 to 10 days before it was reported to the Commission on February 4. Most of the dead fish were gizzard shad, but alewives and perch were included. Of special interest in this case is the proof that massive fish kills in winter are not conspicuous. The several hundred thousand dead fish from the screens had been discharged into the outlet canal where they were washed out into the lake. Yet on February 4, after 7 to 10 days of such kill and discharge to the lake, the dead fish were not visible in the 10 to 20 acres of ice-free open water around the mouth of the discharge canal. Lab studies suggest that fish freshly killed at powerplants in winter often sink to the bottom, perhaps due to contraction of the swim bladder upon entrainment with colder water after being in the heated water of the plume.

One of the latest pieces of evidence on impingement of fishes on Lake Michigan was presented at the National Conference of the American Fishery Society on September 11 by Dr. Robert Benda. He reported that 51,235 fish weighing

4,995 pounds have been taken from the screens of the Palisades powerplant between May 16 and August 25, 1972. These fish include 17 species. While the alewives were about 60 percent by number and 44 percent by weight, the yellow perch, with 8,608 fish, were about 16 percent by number and 40 percent by weight. Trout and salmon totaled only 28 fish but included one 13-pound chinook salmon. Bloater, smelt, shiners and sculpins were included in good numbers. The large catch of 7,343 sculpins in early June suggests opportunity for extremely heavy annual losses of this fish since it is usually most abundant in the 18- to 30-foot depths in winter and early spring.

Argonne has reported the principal mortality at Palisades in January and February to be sculpins. Dr. Benda stated that the intake velocities at Palisades were only about 3/4 foot per second or less.

I would like to point out that the intake velocities of the Palisades plant which amounts to only about 1,000 c.f.s. is one of the more favorably designed intakes of the large plants under construction on the lake.

By contrast, at the Zion plant the intake velocities of up to 2.47 feet per second during nonwinter operations (and up to 3.7 feet per second during winter operation) with a gross volume of up to about 3,400 c.f.s.

presents a very real potential for significant fish losses, as do many of the other plants.

Information from the Great Lakes Fishery Lab indicates high populations of several species of fish in the beach water zone (at depths less than 30 feet deep) where most of the intakes are located.

Wells has shown that peak abundance of bloaters, smelt, trout, and adult yellow perch occurs in 18 to 30 feet of water in summer in southeastern Lake Michigan. Slimy sculpins occur there in February through mid-April; adult alewives show peak abundance in April through June; and young-of-the year alewives in October and November.

Data for other species is less well documented but available data indicate that burbot, lake herring, lake whitefish, and most of the trout and salmon species can be expected to be abundant in the 18- to 30-foot depths in the fall.

Exploratory fishing by the Great Lakes Fishery Lab research vessels in November and December 1971 showed spawning lake trout to be abundant near the intakes of both the Palisades and the Donald C. Cook generating stations.

A second major loss of fish can occur from the entrainment of nonscreenable fish with the intake water. These are considered to include fish eggs and any fish small enough to go through a 3/8 inch screen. Obviously all larval and fry fish can go through the plant as can young fish up to about 2 inches for most species. Apparently few of these fish survive the physical battering, the pressure changes, and thermal shocks of this trip over the condensers, and many which do, expire to long exposure to excess temperature or fall prey to predators as they emerge in the plume in a dazed condition.

Fish eggs sometimes simply disappear on passage through a plant, perhaps due to rupture. Loss of up to 99.7 percent of striped bass eggs has been recorded at a generating station at Vienna, Maryland, apparently through disintegration.

Sampling of fish and larvae at the Chalk Point, Maryland generating station revealed mortality of 92.4 percent on passage through the plant.

At the Haddam Neck, Connecticut nuclear plant, 100 percent mortality of entrained young fish of 9 species was found when temperatures exceeded 86° F. during passage through a 1.14 mile long canal. These fish were mostly alewives and a close relative of the glut herring. The investigator found also that 65 percent of larvae were killed when exposed for only 93 seconds to a 10.7° F. increase to 82.7° F. Eighty-three percent were killed in 93 seconds when exposed to 92.3° F. temperatures.

At the Brayton Point plant at Mount Hope Bay, Rhode Island, a heavy kill of manhaden fry was recently documented by the Environmental Protection Agency. Some flounder were also included in this kill but they were probably a minor percentage. One hundred and sixty-four million manhaden larvae were killed in passage through this plant in 24 hours on July 2, 1971. Subsequent sampling indicated that the kill continued through July and well into August with a minimum observed 24-hour kill of 7 million fry in August.

There are few data on fish eggs or fry passing through the plants on the Great Lakes. Some sampling was conducted at the Point Beach Station and at the Oak Creek Station by the State of Wisconsin from March 3 to May 27, 1971, and March 22 to April 22, 1971, respectively.

At Point Beach, plankton nets fished on 14 days produced a catch of 1 sculpin each on 8 days and a few smelt eggs on another 2 days and an unidentified fish on still another.

The volume of water measured was 5/1,000 of 1 percent of the total volume of flow. Extrapolation of the test results would suggest that around 4 million sculpins may have gone through the plant during 42 days of operation between March 3 and April 29. We realize these data are not necessarily directly translatable, but the significance of the incidence of capture of fish is quite impressive.

Between April 29 and May 19, about 23/1,000 of 1 percent of the water was sampled. Assuming a few smelt eggs to mean 10, then the number passing through the plant may have been on the order of 400,000 in 24 hours on May 4 and more than 1 million on May 5.

The Oak Creek entrainment studies show that in 17 days of fishing, smelt eggs in quantities from few to numerous were taken on 5 days and smelt in size from fry to adult were taken on 7 days and 1 alewife was taken on another.

The number of these organisms in the intake water as compared to the discharge is not known nor is the percent survival of any of these organisms after passage through the plant. In any case, the fact that a minimal sampling took both fish and eggs consistently at these plants suggests a high probability of entrainment and destruction of large numbers of fish and eggs at both plants.

Studies of distribution of fish fry along the eastern shore of Lake Michigan were made by the Great Lakes

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Fishery Laboratory in spring and summer of 1972.

Samples were taken at surface to 4-meter depths and the densities of fry for 3 species were determined. These were alewives, smelt and yellow perch.

Based on these samples only, and assuming that the water is withdrawn from the 3- to 4-meter depth and assuming equal distribution of larvae throughout the entire volume of cooling water, we estimate that entrainment of fry could be as high as 5 million alewives, 100,000 perch fry and 170,000 smelt per day at the Donald C. Cook plant at the periods when highest densities were sampled.

At the Palisades plant, under the same assumptions, entrainment of fry could be as high as .5 million alewives, 150,000 perch, and 60,000 smelt, based on the Bureau of Sport Fisheries and Wildlife data.

I emphasize that we have no reason to believe that we necessarily sampled at the peak density of any of these species, so how high the entrainment might be under some particular set of circumstances at a given time is not quantifiable. It could be lower but it is also possible that it could be many times higher, especially if water from the top 3 meters of depth was entrained. Fry densities were much higher for perch and alewives nearer the surface.

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In work by Dr. Benda at the Palisades plant, plankton sampling of 3.4 million gallons of water in 300 hours resulted in a catch of less than 1,000 fish eggs and 5 larvae. At the pumping rate of 405,000 gallons per minute, this indicates possible passage of 20 million eggs and 100,000 larvae during the 300 hours of sampling. Expansion of these data to cover the full period of May 16 to August 25 suggests massive losses of eggs and larvae may occur at the Palisades site.

The potential loss of whitefish larvae is of great concern to the Fish and Wildlife Service. The whitefish population of the southernmost end of the lake is probably at its all-time low but limited sampling at Saugatuck suggests a potential comeback of these populations. Populations in the northern lake still support commercial and sport fisheries.

Newly hatched whitefish are at the surface in very shallow water in early spring but as temperatures approach 68° F. they move off to deeper and slightly cooler water. 62.6° F. is the temperature at which the bulk of population has been reported in Lake Huron. The fish are found where the 62.6° F. isotherm touches bottom. In Lake Huron this moves offshore between July and mid-September when it reaches a 67-foot depth.

In Lake Michigan, 62.6° F. water would be available from mid-June or early July to mid-September or early October depending on the year.

All Lake Michigan once-through cooling water intakes are within the zone that the 62.6° F. isotherm would pass outward through and beyond.

Recently completed studies of temperature tolerance of whitefish fry at the Great Lakes Fishery Laboratory indicate that the temperature increases and time of exposures to be caused by the Palisades and Zion plants coincide almost exactly with the temperature and time exposures that cause 50 percent mortality from thermal shock alone in whitefish fry acclimated to 62.7° F.

At the Kewaunee plant, the 20° F. increase and 2.2 to 4.7 minutes exposure time will also cause 50 percent mortality from heat alone when intake temperatures are at about 62.7° F.

Whitefish fry not killed by elevated temperatures, mechanical mauling by screens, pumps and cooling systems or by chlorination will likely be more susceptible to capture by predators concentrated in or near the plumes. This is discussed more fully later.

Concentration of fishes by heated effluents has been recognized for some time. This results from temperature but also from currents or availability of crippled food organisms. Fish and other organisms can be attracted by warmer water at times, as in winter, and repelled at other times, as in summer, when preferred or tolerance limits of a species are exceeded.

Several observations on Lake Michigan confirm these points: In summer, elevated temperatures tend to attract some species of warmwater fish as carp, alewives, smallmouth bass, spottail shiners, perch, and gizzard shad, while repelling trout, salmon, and other coldwater species.

When effluent temperatures are below about 65° F. both warm- and coldwater species may be attracted.

Concentration of these fish at the plumes where fishermen can harvest them is often touted as a great benefit brought about by once-through cooling. Perhaps it is, but there are several negative aspects which should not be ignored.

Heavy mortality can result to these concentrated fishes from sudden sharp increases in temperature where fish are confined in a small area, as in a discharge canal. Such a kill of 1,000 game fish (mostly striped bass 10-14 inches in length) on June 7, 1971, has been reported from Tompkins Cove, New York, when condenser cooling water temperatures were sharply increased.

Of special interest are the results of studies which show a major weight loss by fishes overwintering in a plume. At Haddam Neck, on the Connecticut River, studies of tagged fish (brown bullhead and white catfish) showed an average loss of body weight in 4 months of 20 percent for fish wintering in the plume. Some individuals lost as much as 60 percent of body weight. Poor condition was noted for some individuals of these species in the canal during summer.

Of perhaps greater relevance than temperature increase is the sudden interruption of heat input during winter.

A number of low temperature kills in marine waters are known. One recent case was a massive kill at Oyster Creek on Barnegat Bay, New Jersey. A drop of 22° F. from 59° F. to 37° F., during an operational shutdown, resulted in a kill of menhaden, anchovies, bluefish, striped bass, and herring.

A conspicuous freshwater kill occurred in February 1971 on the Susquehannah River when a leak in a plant at York Haven, Pennsylvania forced a sudden shutdown. Temperatures dropped from a high of around 72° F. to about 38° F. within 1 hour. A tally of dead fish 3 days after the sudden outage was about 15,000 game fish. Fish smaller than 5 or

6 inches and certain rough fish were not tallied. The incidence of dead fish which did not float or were not otherwise visible is unknown.

Two kills were recorded at Fremont, Ohio on the Sandusky River, tributary to Lake Erie, in January 1967, and in the winter of 1968. I do not have details of these kills.

The records of kills due to winter shutdown at electric plants on Lake Michigan are slow to appear. However, I suggest that this deserves special investigation and close observation of plants during winter shutdown.

Numerous shutdowns without effect are claimed, but assurance that close examinations were made at that time would be most reassuring. The difficulty of detecting kills is evident. The incident of huge numbers of dead fish discharged to the lake at the Campbell plant without any being visible in a 10-20 acre area of open water is a case in point. Laboratory evidence that recently dead fish moving from hot to cold water will sink is important as is the short period of daylight, poor observing conditions, and ice cover, during Lake Michigan winters. The ability of predators and scavengers to remove a large number of dead fish from the surface in a short time is also important.

The likelihood of kills when sudden outage of plants occurs on Lake Michigan seems high if we examine known lethal temperatures for some Lake Michigan fishes. Data indicate that 50 percent kill might be expected as follows:

1. Coho salmon acclimated to 41° F. are killed by a sudden drop of 8° F.

2. Chinook salmon and ciscoes acclimated to 43° F. would be killed by an 11° F. decrease.

3. Gizzard shad acclimated to about 50° F. would die from an 18° F. temperature drop.

4. Emerald shiners acclimated to about 54° F. will die following a sudden 22° F. drop.

5. White suckers acclimated to 62° F. would be killed by a drop of about 30° F.

I might note that all of these are sudden drops that we talk about, not normal seasonal adjustments over a period of several days or weeks.

Available data for brook trout and sculpin suggest they might not be affected by a sudden drop in temperature.

However, we lack specific data for several important species. It is probable that such fish as whitefish, brown and rainbow trout, spottail shiners, smelt, and alewives have temperature change tolerances no greater than those listed above.

A review of the temperature rise at some 20 plants on the lake (existing and under construction) suggests that a sudden outage in winter could cause a fish kill if any of several species of fish were in the plume and were acclimated to warmed water of the plume.

Another source of damage to fish populations from the discharge of powerplants is from entrainment of fish fry and other weak-swimming organisms into the plume.

High velocity jet discharges are dependent on quick entrainment and mixing with the cooler receiving water.

Research at the Great Lakes Fishery Laboratory has shown that thermal shock increases the vulnerability of whitefish fry to predation. Fry acclimated to 64.4° F. (their preferred temperature is 62.6° F.) and given a 1-minute shock exposure at 84.2° F. are significantly more susceptible to predation. The time of 3-minute exposure to this 20° F. increase could occur in the mixing jet of probably the Zion plant and many of the others as well.

The increase in predation from shock may be one of the more significant impacts of the waste heat discharge. This shock may not only result from temperature but also from physical damage during passage through a plant's cooling system or while entrained or from sublethal doses of biocides. Weak swimmers which are entrained may simply be displaced by being buoyed to the surface in the warmest part of a floating plume where chance of attack by predators is increased.

Combinations of thermal, chemical, and mechanical impacts probably would be additive and vulnerability would increase where one or more impacts coincides with another.

Effects of sinking plumes on incubating fish eggs may be especially important. Of interest is that the sinking plume does not appear to have been recognized as existing in Lake Michigan until the questions were raised in discussions with Argonne Laboratory technicians during a working session of the Lake Michigan Enforcement Conference Technical Committee during the fall of 1970.

Research by Argonne and by others has proven the existence of the plumes now, and the Argonne work has shown that even modest-sized thermal plants can cause bottom plumes of as much as 2.6° C. over ambient at a distance of 1,525 meters from the discharge and a difference of 4.0° C. at closer ranges.

I might add that what a large plume will do -- such as Zion or Donald C. Cook -- may be an entirely different and larger matter.

Sudden changes of up to about 4.0° C. in bottom temperatures were recorded at some locations. Argonne concluded that hatching of lake herring eggs could be advanced 7 days by the higher temperatures caused by the sinking plumes. Possible stimulation of periphyton growth by higher temperatures was also recognized.

Recent research at the Great Lakes Fishery Laboratory on the effects of temperature on the incubation and hatching of the eggs of whitefish has shown a 136-day incubation period under simulated normal lake conditions.

Increase of temperatures by 1.8°, 3.6° and 7.2° F. every fourth day during the full incubation period shortened the incubation to 138, 134, and 125 days, respectively.

Constant addition of 1.8°, 3.6° and 7.2° F. over natural temperatures resulted in hatching in 128, 115, and 86 days, respectively.

A discussion of the shortening of the incubation of whitefish eggs is included in Appendix A of the Palisades Environmental Impact Statement by the Atomic Energy Commission. This indicates a shortening of even 13 days would significantly reduce the production of whitefish fry and the abundance of whitefish for sometime thereafter.

Another item of concern is the effect of temperature on attainment of sexual maturity and egg viability of fishes.

Y. Barber

Research at the National Water Quality Laboratory of EPA at Duluth has shown that yellow perch achieved optimum gametogenesis and spawning when exposed to 4.0° C. for a period of 185-200 days. Large deviation from these values reduced fecundity in terms of production of viable eggs, number of females spawning and the quality of the spawn. Deviations from the optimum 185 days at 4.0° C. may affect males and cause a greater proportion of unfertilized spawnings.

Perch were among the fish killed at the Campbell plant and this suggests that they are attracted from the 4.0° C. water where their fecundity may be affected by higher temperatures.

An inconspicuous but possibly significant effect of increased temperature on fish is in the increased incidence of disease in fish at higher temperatures.

A review of the literature shows clearly that elevated temperature plays a vital role in incidence and severity of infection. It has been demonstrated that higher temperatures drastically increased the effects of kidney disease, furunculosis, vibro disease and columnaris in young salmonids.

The effects of temperature and disease is documented for a major kill of perch in Chesapeake Bay, for an incidence of columnaris disease in the Columbia River and in the near obliteration of the sockeye salmon in the Columbia River in 1941.

There already are serious problems with fungal infections, perhaps in concert with other diseases, in male brown trout along the Wisconsin shore when the fish enter warmer shore waters to spawn. Mortalities of 88 percent in 1968 and nearly 100 percent in 1970 were recorded for male brown trout.

Heavy fungus, perhaps coincident with bacterial infection, has been noted on spawning browns and rainbows which enter Michigan streams to spawn.

Kidney lesions have been reported in Lake Michigan coho salmon and dead salmon with kidney lesions have been recovered from the lake. In 1970, kidney disease was reported from 1.83 percent of 273 cohos examined.

Concentration of fishes in plumes may offer opportunity for spread of disease from fish more severely infected because of their presence in warm water.

The uptake of some pollutants by fish appears to be higher at higher water temperatures.

Recent research at the Great Lakes Fishery Laboratory has shown that lake trout exposed to 0.20 ppb methylmercury accumulated almost twice as much from water at 10° C. as from water at 5° C.

Rainbow trout exposed to similar concentrations for 8 weeks in water at 5°, 10°, and 15° C. accumulated 50 percent and 100 percent more at the higher temperatures than at 5° C.

Temperature may affect the uptake of other pollutants by fish. It has been shown that a correlation exists between respiration and uptake of DDT by the mosquito fish. Though Gambusia are not Lake Michigan fish, this finding suggests a relationship between temperature and DDT uptake which cannot be ignored in view of the high levels of DDT and PCB now occurring in some Lake Michigan fishes.

It is an established fact that some toxicants are more lethal to fish at higher temperatures than at lower temperatures. It has been suggested that some chemicals used in powerplants may also be more toxic at higher temperatures.

A matter of concern is the effect of temperature on higher nutrient release from bottom sediments under anaerobic conditions. Recent research at the Ann Arbor Fishery Laboratory has confirmed that phosphorus is released at a rate 4 times greater at 77° F. than at 44° F.

Much has been said about planktonic algae in Lake Michigan but we still know far too little about the effects of temperature on this primary element of the aquatic biota.

A 1969 report indicates that within some temperature ranges (68° F. or cooler) a higher temperature stimulated photosynthesis, but above 68° F. further increases inhibited it. At high ambient temperatures, a permanent inhibition of photosynthesis occurred for phytoplankton that had passed through the powerplant. During chlorination all phytoplankton passing through the plant were killed.

A study at Turkey Point, Florida indicated a decrease in species diversity with temperatures of 9° F. above intake and blue-green algae increased when ambient temperatures were 78.8° to 82.4° F.

Other workers have found that increased temperature from a powerplant on the Delaware River resulted in a decrease in the total number of phytoplankton species but an increase in blue-green algae species.

In the Susquehannah River, heated water reduced the number of species of algae.

However, the effects of heated plumes on the productivity of planktonic algae relative to suppression of desirable species and blooms of undesirable forms has not been clearly established.

The movement of discrete water masses with each carrying its own assemblage of planktonic forms through the sample area results in complications of the study. Most discharge sites are potentially productive areas because of nutrients released by organisms killed on passage through the plant.

Entrained algae carried to the surface in the nutrient-rich, buoyant plumes would appear to be favorable to increased growth.

Chlorination may debilitate many of the algal species and selectively affect the production of desirable or undesirable species.

These considerations viewed with respect to evidence of periphyton production, to be discussed next, suggest that net increases may be occurring among populations of planktonic algae in heated plumes in Lake Michigan.

The periphyton communities seem to differ from the planktonic algae communities in that they seem to be responding to heated effluents in a predictable manner.

Connecticut River investigations showed similarity of planktonic communities above and below a heated discharge. Among the periphyton, however, diatoms dominated samplers above the discharge and blue-greens below. One year after the plant began operation, numbers of organisms in the effluent were 4.3 times as abundant as before the discharge when numbers were similar in both areas.

Studies at Point Beach in the summer of 1971 showed significantly greater biomass at near field stations than at far stations on a temperature difference of only 3.6° F. Winter stimulation of periphyton growth by sinking plumes could be of significance and should be carefully searched for.

Cleaning of condenser tubes in powerplants to remove biological fouling is essential to plant maintenance and efficiency. Heat shock, chemicals, and passing mechanical devices through the system have all been used.

Chemicals are generally the most serious threat to the ecology. Chlorine as hypochlorite or gaseous chlorine is probably the most widely used biocide in powerplant cooling systems. Various concentrations are used and effectiveness of chloramines can be hampered by high BOD or ammonia levels.

Unfortunately, all these forms of chlorine are toxic to aquatic organisms and often at levels below those used in powerplants.

During chlorination, all the planktonic organisms, including fish larvae, may be killed in the water passing through the plant while large numbers probably are affected in the plume.

Long-term exposure of rainbow trout to as little as 0.05 ppm may be toxic.

Other organisms have extremely low tolerances for chlorine on long-term exposure.

Fish kills have resulted from chlorine discharges into plume areas where fish were concentrated. This may have been a factor in a fish kill affecting the intake screens at the Waukegan powerplant.

Some fish detect and avoid chlorine at concentrations as low as 0.001 ppm and several species have been observed avoiding discharges when chlorine was present. Conversely fish have been observed dying by thousands immediately after chlorination began.

If chlorination during winter drives fish out of heated areas to which they are acclimated, the possibility exists that these fish would be killed by low temperature shock.

Benthic and psammo-littoral communities may be especially hard hit by chlorine residuals in sinking plumes which flow over the bottom. The invertebrate species of these communities appear to be especially sensitive to chlorine.

Unfortunately, some power -- excuse me, I'm sorry. I have got the wrong word there: The invertebrate species of these communities appear to be especially sensitive to biocides.

Unfortunately, some powerplants appear to use excessive amounts of chlorine at times, perhaps because of inadequate measurement techniques.

More studies of acute and chronic effects of chlorine are needed. Preliminary evidence indicates that sublethal doses of chloramine can cause reduction of egg production in fish and invertebrates.

Gentlemen, in the interest of time, I will not summarize this long list of problems with once-through cooling at powerplants. Needless to say, the draft document provided you contains an elaboration on these matters and the references for the information it contains. I commend this document to your careful consideration. I believe it provides ample proof of the significant adverse impact of once-through cooling on aquatic resources and of the necessity of closed-cycle cooling for all the larger powerplants on the shores of Lake Michigan.

MR. MAYO: Thank you, Mr. Barber.

Do we have any questions or comments by the conferees?

Mr. Currie.

MR. CURRIE: Yes.

Y. Barber

Mr. Barber, in your report, one of the things which is discussed is the effect, on page 52, on algae. And I believe you refer to certain tests which find a greater concentration of blue-green algae in plumes than in the ambient water and a greater biomass of algae in the plume than outside.

Do you view this evidence as impairing the conference's earlier finding No. 17 which was that the residence time of algal cells in the heated plume from a properly designed single 1,000 MW plant is probably too short to cause any significant problems?

MR. BARBER: On this table over there is my copy of those conclusions, and by that item there is a little red "X" which indicates I did feel here was an item that perhaps we have sufficient evidence to warrant some change in the conclusion.

Now, let me clarify this. We are talking about sessile organisms which are resident in an area and are subjected to the heat for prolonged periods in the periphyton.

If we look at the single-celled floating plankton organisms which simply pass through and are carried on out of the plume area by water currents, I believe you will find this green book concludes that we don't really yet have all of the evidence to conclude that there is an increase in this.

But when you say algal mass, yes, I think we do have an increase in the biomass in the periphyton communities subjected to the heat.

I would regard these two incidents as a very strong indication of that.

MR. CURRIE: But this effect is, so far as we know from the evidence that is now before us, limited to the attacked forms of algae?

MR. BARBER: I think there are those who might feel that there is evidence, but I am not an algologist and we concluded that we did not yet have the information in hand.

MR. CURRIE: Secondly, one of the conclusions that the Illinois Board reached was that the area affected by a single powerplant, if well designed, was likely to be rather small, and that, therefore, it might not have any very significant effect on the lake as a whole.

And I gather from perusing this report that your conclusion might lead to some modification of that position which is -- and I would like to check with you whether this is an accurate characterization of what you are saying -- that even though the area affected may be rather small, that because a heated plume will attract a substantial congregation of fish from miles around, the effects which that plant might have are greater than might be expected from the small amount of the area that is actually affected. Is that a fair characterization?

MR. BARBER: Yes, sir, I would agree with that. I would also point out that--as I did in the statement -- that the effects of powerplants are very much in both ends. The entrainment and impingement of fish on the intakes is a very vital part of the picture; it is not just the waste discharge which draws the fish where they may be subject to adverse impacts.

But a single plant -- let's take, for example, the Zion Plant, whose intakes, if I remember, are somewhere in the 20-plus-foot range, 3,400 c.f.s., if I remember, taken in through the two discharges combined, with intake velocities of 2.4 or 2.5, if I remember correctly, feet per second -- I think it is inevitable that under some circumstances that plant could engulf or envelope a great deal of aquatic life.

We must recognize that we do have continual movements of currents in these shores in response to wind, temperature, and other factors, and if you happen to have a prevailing current that sails by this point for several days at a time, this plant will be sampling that current at all times.

If the critical temperature of plumes as, for example, for the whitefish, happened to involve those isotherms in the neighborhood of that intake, and at some point they were to pass that, then the opportunity for entrainment of very large numbers of fry or larval fish is certainly there. And we are not at all convinced, as many people seem to be, that these areas of Lake Michigan are really that sterile. This is a 365-day a year proposition that life goes on out there. These plants work 365 days a year, and these fish and other things live in that lake 365 days a year. And while we hate to confess so much ignorance, the truth is that we don't know where a lot of these fish are, but the more evidence we gather, the better we think we understand that they do use these shallow areas and they do pass through these zones.

A plant sitting there operating full-time inevitably gets, let's say, a crack at them at some point in time.

MR. CURRIE: Well, I was somewhat struck by the rather large numbers of fish that you were discussing in each instance of fish kill at an individual plant that might not have a very large amount of influence if you look simply at the acres which are significantly warmed.

MR. MAYO: Do you have any further questions, Mr. Currie?

MR. CURRIE: No, thank you.

MR. MAYO: Any other questions or comments, gentlemen?

MR. PURDY: Mr. Chairman, will Mr. Barber be available to the conferees as we progress into this thermal question? There is a great deal of information here that has been presented, and I think it would be most valuable if we had a chance to digest it and discuss it with Mr. Barber.

MR. MAYO: Will you be available the remainder of the day, Mr. Barber?

MR. BARBER: I will be here all day, sir, and as long as you need me I will be here. I am accompanied by Mr. Tom Edsall, who is one of the principal -- perhaps the principal author of this paper and who will assist me in providing you with any answers that you may need.

MR. PURDY: I think it would be most valuable and even if we don't get at it today, at some later point in time, I would hope Mr. Barber's people would be available to us.

In some of the studies cited, has there been any attempt to asses what effect the, say, sanitary waste discharges from that particular plant might have and how that might influence what is observed within the plume? In some instances, the powerplants have their own sanitary waste disposal system and treated effluent is discharged into the plume.

Would this have an influence on what is, say, observed to take place in the plume with respect to periphyton, and so forth?

MR. BARBER: I am not aware of any such evaluation of that. That does not mean they have not been made.

At most plants that I am familiar with, the total volume of discharge from the domestic sewage system is so small, and the volume of polluting water with which it is diluted is so great that I would suspect, in many cases, it would be difficult to separate the effect of that waste, as nutrient, from the probably much greater supply of nutrient generated by the kill of the microscopic and the small organisms passing through the plant.

MR. MAYO: Any other questions, gentlemen?

Mr. Barber, if you would leave a copy of your remarks with Mr. Pratt, we will arrange to have them copied as quickly as possible and have copies made available to the conferees and the press and other interested parties as quickly as we can.

MR. BARBER: All right, sir. I would like to say that this is a rather rough marked-up copy that I am using and there are two or three little errors I wish to correct.

MR. MAYO: Some of us are rather rough, marked-up conferees! (Laughter)

MR. BRYSON: The next Federal agency that has requested an opportunity to speak to the conferees is Mr. Robert J. Catlin of the U.S. Atomic Energy Commission, Washington, D.C.

STATEMENT OF ROBERT J. CATLIN, DIRECTOR, DIVISION OF ENVIRONMENTAL AFFAIRS, U.S. ATOMIC ENERGY COMMISSION, WASHINGTON, D. C.

MR. CATLIN: Mr. Chairman, conferees, ladies and gentlemen.

My name is Robert Catlin. I am the Director of the Division of Environmental Affairs of the U.S. Atomic Energy Commission, and I am accompanied here today by Mr. Walter Belter, also of the Division of Environmental Affairs.

We appreciate the opportunity to present a statement at this, the Fourth Session of the Lake Michigan Enforcement Conference.

At the Third Session of the conference held in May 1971 --

MR. MAYO: Excuse me, Mr. Catlin.

I have a request to make to the press. If the lights currently aren't in use, would it be possible for them to be turned off? They are quite uncomfortable. We are more than pleased to have them on when they are being used for camera work; we have no objection at all. But when they are not being used, it is quite an eye strain.

Thank you very much.

MR. CATLIN: At the Third Session of the conference held in May 1971, Mr. Enrico Conti presented a statement on behalf of the Atomic Energy Commission in connection with its developmental responsibility concerning the report of the conference's Technical Committee on Thermal Discharges to Lake Michigan dated January 29, 1971. It will be my purpose to update that presentation.

In so doing, I will make certain observations on the activities conducted pursuant to the AEC's regulatory authority during this last year. I do not purport to speak for the regulatory arm of the Commission since, under the statute, their regulatory role is separate and apart from the developmental and research role of the Commission which I represent. Moreover, decisions in several Lake Michigan licensing actions are presently pending in the regulatory process. Since the Commission may be the final arbiter of these cases, my remarks -- in total -- will review present activities rather than present a statement of policy on the part of the Commission or its staff.

At the risk of intrusion into the legal field, I will briefly review several developments that relate to the subject of this conference on thermal water quality standards. They relate to the role of the AEC -- through its regulatory branch -- in its address to specific nuclear licensing actions affecting the Great Lakes, and will serve to put in context the environmental statements that have become available on Lake Michigan plants.

On July 23, 1971, the U.S. Court of Appeals for the District of Columbia Circuit rendered its decision in Calvert Cliffs Coordinating Committee, Inc. v. Atomic Energy Commission. This decision was principally directed toward an interpretation of the scope of the National Environmental Policy Act and the AEC's responsibilities related to the implementation of this Act.

On September 9, 1971, in response to the Court's conclusions, the AEC issued an amendment to Part 50, Appendix D, of its regulations. A copy of the revised Appendix D regulations is enclosed to my statement for inclusion in the record of this hearing.

(The document above referred to follows in its entirety, and is identified as Enclosure 1.)

(As revised September 9, 1971--includes correction of September 21, 1971, and further amendments of September 30, 1971)

36 FR 18071

APPENDIX D—INTERIM STATEMENT OF GENERAL POLICY AND PROCEDURE: IMPLEMENTATION OF THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969 (PUBLIC LAW 91-190)

INTRODUCTION

On July 23, 1971, the U.S. Court of Appeals for the District of Columbia Circuit rendered its decision in Calvert Cliffs' Coordinating Committee, Inc., et al. v. United States Atomic Energy Commission, et al., Nos. 24,839 and 24,871, holding that Atomic Energy Commission regulations for the implementation of the National Environmental Policy Act of 1969 (NEPA) in AEC licensing proceedings did not comply in several specified respects with the dictates of that Act, and remanding the proceedings to the Commission for rule making consistent with the court's opinion.

The Court of Appeals' decision required, in summary, that the Commission's rules make provision for the following:

1. Independent substantive review of environmental matters in uncontested as well as contested cases by presiding Atomic Safety and Licensing Boards.

2. Consideration of NEPA environmental issues in connection with all nuclear power reactor licensing actions which took place after January 1, 1970 (the effective date of NEPA).

3. Independent evaluation and balancing of certain environmental factors, such as thermal effects, notwithstanding the fact that other Federal or State agencies have already certified that their own environmental standards are satisfied by the proposed licensing action. In each individual case, the benefits of the licensing action must be assessed and weighed against environmental costs; and alternatives must be considered which would affect the balancing of values.

4. NEPA review, and appropriate action after such review, for construction permits issued prior to January 1, 1970, in cases where an operating license has not as yet been issued. The court's opinion also states that, in order that this review be as effective as possible, the Commission should consider the requirement of a temporary halt in construction pending its review and the backfitting of technological innovations.

As summary background, the National Environmental Policy Act of 1969 (Public Law 91-190) became effective on January 1, 1970. The Commission published on April 2, 1970, in its initial implementation of the Act, an Appendix D to Part 50 stating general Commission policy and procedure for exercising AEC responsibilities under the Act in its licensing proceedings (35 F.R. 5463). Substantial amendments to Appendix D were published on December 4, 1970 (35 F.R. 18469), and further minor amendments on July 7, 1971 (36 F.R. 12731).

The amendments to Appendix D issued herewith have been adopted by the Commission to make interim changes in its regulations for implementation of NEPA in AEC licensing proceedings in light of the Court of Appeals' decision.

A. *Basic procedures.* 1. Each applicant[1] for a permit to construct a nuclear power reactor, testing facility, or fuel reprocessing plant, or such other production or utilization facility whose construction or operation may be determined by the Commission to have a significant impact on the environment, shall submit with his application three hundred (300) copies, in the case of a nuclear power reactor, testing facility, or fuel reprocessing plant, or two hundred (200) copies, in the case of such other production or utilization facility, of a separate document, entitled "Applicant's Environmental Report—Construction Permit Stage," which discusses the following environmental considerations:

(a) The environmental impact of the proposed action,

(b) Any adverse environmental effects which cannot be avoided should the proposal be implemented,

(c) Alternatives to the proposed action,

(d) The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and

(e) Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

2. The discussion of alternatives to the proposed action in the Environmental Report required by paragraph 1 shall be sufficiently complete to aid the Commission in developing and exploring, pursuant to section 102 (2) (D) of the National Environmental Policy Act, "appropriate alternatives * * * in any proposal which involves unresolved conflicts concerning alternative uses of available resources."

3. The Environmental Report required by paragraph 1 shall include a cost-benefit analysis which considers and balances the environmental effects of the facility and the alternatives available for reducing or avoiding adverse environmental effects, as well as the environmental, economic, technical and other benefits of the facility. The cost-benefit analysis shall, to the fullest extent practicable, quantify the various factors considered. To the extent that such factors cannot be quantified, they shall be discussed in qualitative terms. The Environmental Report should contain sufficient data to aid the Commission in its development of an independent cost-benefit analysis covering the factors specified in this paragraph.

4. The Environmental Report required by paragraph 1 shall include a discussion of the status of compliance of the facility with applicable environmental quality standards and requirements (including, but not limited to, thermal and other water quality standards promulgated under the Federal Water Pollution Control Act) which have been imposed by Federal, State, and regional agencies having responsibility for environmental protection. In addition, the environmental impact of the facility shall be fully discussed with respect to matters covered by such standards and requirements irrespective of whether a certification from the appropriate authority has been obtained (including, but not limited to, any certification obtained pursuant to section 21(b) of the Federal Water Pollution Control Act[2]). Such discussion shall be reflected in the cost-benefit analysis prescribed in paragraph 3. While satisfaction of AEC standards and criteria pertaining to radiological effects will be necessary to meet the licensing requirements of the Atomic Energy Act, the cost-benefit analysis prescribed in paragraph 3 shall, for the purposes of the National Environmental Policy Act, consider the radiological effects, together with the thermal effects and the other environmental effects, of the facility.

5. Each applicant for a license to operate a production or utilization facility described in paragraph 1, shall submit with his application three hundred (300) copies, in the case of a nuclear power reactor, testing facility, or fuel reprocessing plant, or two hundred (200) copies, in the case of any other production or utilization facility described in paragraph 1, of a separate document, to be entitled "Applicant's Environmental Report—Operating License Stage," which discusses the same environmental considerations described in paragraphs 1-4, but only to the extent that they differ from those discussed in the Applicant's Environmental Report previously submitted in accordance with paragraph 1. The "Applicant's Environmental Report—Operating License Stage" may incorporate by reference any information contained in the Applicant's Environmental Report previously submitted in accordance with paragraph 1. With respect to the operation of nuclear power reactors, the applicant, unless otherwise required by the Commission, shall submit the "Applicant's Environmental Report—Operating License Stage" only in connection with the first licensing action that would authorize full-power operation of the facility,[3] except that such report shall be submitted in connection with the conversion of a provisional operating license to a full-term license.

6. After receipt of any Applicant's Environmental Report, the Director of Regulation or his designee will cause to be published in the FEDERAL REGISTER a summary notice of the availability of the report, and the report will be placed in the AEC's Public Document Rooms at 1717 H Street NW., Washington, DC, and in the vicinity of the proposed site, and will be made available to the public at

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[1] Where the "applicant", as used in this appendix, is a Federal agency, different arrangements for implementing the National Environmental Policy Act may be made, pursuant to the guidelines established by the Council on Environmental Quality.

[2] No permit or license will, of course, be issued with respect to an activity for which a certification required by section 21(b) of the Federal Water Pollution Control Act has not been obtained.

[3] This report is in addition to the report required at the construction permit stage.

the appropriate State, regional, and metropolitan clearinghouses.[4] In addition, a public announcement of the availability of the report will be made. Any comments by interested persons on the report will be considered by the Commission's regulatory staff, and there will be further opportunity for public comment in accordance with paragraph 7. The Director of Regulation or his designee will analyze the report and prepare a draft detailed statement of environmental considerations. The draft detailed statement will contain an assessment of the matters specified in paragraph 1; a preliminary cost-benefit analysis based on the factors specified in paragraph 3; and an analysis pursuant to section 102(2)(D) of the National Environmental Policy Act, of appropriate alternatives to the proposed licensing action in any case which involves unresolved conflicts concerning alternative uses of available resources (i.e., an analysis of alternatives which would alter the environmental impact and the cost-benefit balance). The Commission will then transmit a copy of the report and of the draft detailed statement to such Federal agencies designated by the Council on Environmental Quality as having "jurisdiction by law or special expertise with respect to any environmental impact involved" or as "authorized to develop and enforce environmental standards" as the Commission determines are appropriate,[5] and to the Governor or appropriate State and local officials, who are authorized to develop and enforce environmental standards, of any affected State. The transmittal will request comment on the report and the draft detailed statement within forty-five (45) days in the case of Federal agencies and seventy-five (75) days in the case of State and local officials, or within such longer time as the Commission may deem appropriate. (In accordance with § 2.101 (b) of Part 2, the Commission will also send a copy of the application to the Governor or other appropriate official of the State in which the facility is to be located and will publish in the FEDERAL REGISTER a notice of receipt of the application, stating the purpose of the application and specifying the location at which the proposed activity will be conducted.) Comments on an "Applicant's Environmental Report—Operating License Stage" and on the draft detailed statement prepared in connection therewith will be requested only as to environmental matters that differ from those previously considered at the construction permit stage. If any such Federal agency or State or local official fails to provide the Commission with comments within the time specified by the Commission, it will be presumed that the agency or official has no comment to make, unless a specific extension of time has been requested.

7. In addition, upon preparation of a draft detailed statement, the Commission will cause to be published in the FEDERAL REGISTER a summary notice of the availability of the Applicant's Environmental Report and the draft detailed statement. The summary notice to be published pursuant to this paragraph will request, within seventy-five (75) days or such longer period as the Commission may determine to be practicable, comment from interested persons on the proposed action and on the draft statement. The summary notice will also contain a statement to the effect that the comments of Federal agencies and State and local officials thereon will be available when received.[6]

8. After receipt of the comments requested pursuant to paragraphs 6 and 7, the Director of Regulation or his designee will prepare a final detailed statement on the environmental considerations specified in paragraph 1, including a discussion of problems and objections raised by Federal, State, and local agencies or officials and private organizations and individuals and the disposition thereof. The detailed statement will contain a final cost-benefit analysis which considers and balances the environmental effects of the facility and the alternatives available for reducing or avoiding adverse environmental effects, as well as the environmental, economic, technical, and other benefits of the facility. The cost-benefit analysis will, to the fullest extent practicable, quantify the various factors considered. To the extent that such factors cannot be quantified, they will be discussed in qualitative terms. In the case of any proposed licensing action that involves unresolved conflicts concerning alternative uses of available resources, the Detailed Statement will contain an analysis, pursuant to section 102(2)(D) of the National Environmental Policy Act, of alternatives to the proposed licensing action which would alter the environmental impact and the cost-benefit balance. Compliance of facility construction or operation with environmental quality standards and requirements (including, but not limited to, thermal and other water quality standards promulgated under the Federal Water Pollution Control Act) which have been imposed by Federal, State and regional agencies having responsibility for environmental protection will receive due consideration. In addition, the environmental impact of the facility will be considered in the cost-benefit analysis with respect to matters covered by such standards and requirements, irrespective of whether a certification from the appropriate authority has been obtained (including, but not limited to, any certification obtained pursuant to section 21(b) of the Federal Water Pollution Control Act[7]). While satisfaction of AEC standards and criteria pertaining to radiological effects will be necessary to meet the licensing requirements of the Atomic Energy Act, the cost-benefit analysis will, for the purposes of the National Environmental Policy Act, consider the radiological effects, together with the thermal effects and the other environmental effects, of the facility. On the basis of the foregoing evaluations and analyses, the detailed statement will include a conclusion by the Director of Regulation or his designee as to whether, after weighing the environmental, economic, technical and other benefits against environmental costs and considering available alternatives, the action called for is issuance or denial of the proposed permit or license or its appropriate conditioning to protect environmental values.

Detailed statements prepared in connection with an application for an operating license will cover only environmental considerations which differ from those discussed in the detailed statement previously prepared in connection with the application for a construction permit and may incorporate by reference any information contained in the detailed statement previously prepared in connection with the application for a construction permit. With respect to the operation of nuclear power reactors, it is expected that in most cases the detailed statement will be prepared only in connection with the first licensing action that authorizes full-power operation of the facility,[8] except that such a detailed statement will be prepared in connection with the conversion of a provisional operating license to a full-term license.

9. The Commission will transmit to the Council on Environmental Quality copies of (a) each Applicant's Environmental Report, (b) each draft detailed statement, (c) comments thereon received from Federal, State, and local agencies and officials and private organizations and individuals, and (d) each detailed statement prepared pursuant to paragraph 8. Copies of such report, draft statements, comments and statements will be made available to the public as provided in this appendix and as provided in 10 CFR Part 9[9] and will accompany the application through, and will be considered in, the Commission's review processes. After each detailed statement becomes available, a notice of its availability will be published in the FEDERAL REGISTER, and copies will be made available to appropriate Federal, State and local agencies and State, regional, and metropolitan clearinghouses.[4] To the maximum extent practicable, no construction permit or operating license in connection with which a detailed statement is required by paragraph 8 will be issued until ninety (90) days after the draft detailed statement so required has been circulated for comment, furnished to the Council on Environmental Quality, and made available to the public, and until thirty (30) days after the final detailed statement therefor has been made available to the Council and the public. If the final detailed statement is filed within ninety (90) days after a draft statement has been circulated for comment, furnished to the Council and made available to the public, the thirty (30) day period and ninety (90) day period may run concurrently to the extent that they overlap. In addition, to the maximum extent practicable, the final detailed statement will be publicly available at least thirty (30) days before the commencement of any related evidentiary hearing that may be held.

10. In a proceeding for the issuance of a construction permit or an operating license for a production or utilization facility described in paragraph 1 in which a hearing is held, the Applicant's Environmental Report, comments thereon, and the detailed statement will be offered in evidence. Any party to the proceeding may take a position and offer evidence on environmental aspects of

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[4] Such clearinghouses have been established pursuant to Office of Management and Budget Circular A-95 to provide liaison and coordination between Federal and State, regional or local agencies with respect to Federal programs. The documents will be made available at appropriate State, regional and metropolitan clearinghouses only with respect to proceedings in which the draft detailed statement is circulated after June 30, 1971, in accordance with the "Guidelines on Statements on Proposed Federal Actions Affecting the Environment" of the Council on Environmental Quality (36 F.R. 7724).

[5] Requests for comments on Environmental Reports and draft detailed statements from the Environmental Protection Agency will include a request for comments with respect to water quality aspects of the proposed action for which a certification pursuant to section 21(b) of the Federal Water Pollution Control Act has been issued, and with respect to aspects of the proposed action to which section 309 of the Clean Air Act is applicable.

[6] This paragraph applies only with respect to proceedings in which the draft detailed statement is circulated after June 30, 1971, in accordance with the "Guidelines on Statements on Proposed Federal Actions Affecting the Environment" of the Council on Environmental Quality (36 F.R. 7724).

[7] No permit or license will, of course, be issued with respect to an activity for which a certification required by section 21(b) of the Federal Water Pollution Control Act has not been obtained.

[8] This statement is in addition to the statement prepared at the construction permit stage.

[9] 10 CFR Part 9 implements the Freedom of Information Act, section 552 of title 5 of the United States Code.

the proposed licensing action in accordance with the provisions of Subpart G of 10 CFR Part 2.

11. In a proceeding for the issuance of a construction permit for a production or utilization facility described in paragraph 1, and in a proceeding for the issuance of an operating license in which a hearing is held and matters covered by this appendix are in issue, the Atomic Safety and Licensing Board will (a) determine whether the requirements of section 102(2) (C) and (D) of the National Environmental Policy Act and this appendix have been complied with in the proceeding, (b) decide any matters in controversy among the parties, (c) determine, in uncontested proceedings, whether the NEPA review conducted by the Commission's regulatory staff has been adequate, and (d) independently consider the final balance among conflicting factors contained in the record of the proceeding for the permit or license with a view to determining the appropriate action to be taken.

The Atomic Safety and Licensing Board, on the basis of its conclusions on the above matters, shall determine whether the permit or license should be granted, denied, or appropriately conditioned to protect environmental values. The Atomic Safety and Licensing Board's initial decision will include findings and conclusions which may affirm or modify the contents of the detailed statement described in paragraph 8. To the extent that findings and conclusions different from those in the detailed statement are reached, the detailed statement shall be deemed modified to that extent and, as modified, transmitted to the Council on Environmental Quality and made available to the public pursuant to paragraph 9. If the Commission or the Atomic Safety and Licensing Appeal Board, in a decision on review of the initial decision, reaches conclusions different from the Atomic Safety and Licensing Board with respect to environmental aspects, the detailed statement shall be deemed modified to that extent and, as modified, transmitted to the Council on Environmental Quality and made available to the public pursuant to paragraph 9.

12. The Atomic Safety and Licensing Board, during the course of the hearing on an application for a license to operate a production or utilization facility described in paragraph 1, may authorize, pursuant to § 50.57(c), the loading of nuclear fuel in the reactor core and limited operation within the scope of § 50.57(c), upon compliance with the procedures described therein. Where any party to the proceeding opposes such authorization on the basis of matters covered by this appendix, the provisions of paragraph 11 shall apply in regard to the Atomic Safety and Licensing Board's determination of such matters. Any license so issued will be without prejudice to subsequent licensing action which may be taken by the Commission with regard to the environmental aspects of the facility, and any license issued will be conditioned to that effect.

13. The Commission will incorporate in all construction permits and operating licenses for production and utilization facilities described in paragraph 1, a condition, in addition to any conditions imposed pursuant to paragraph 11, to the effect that the licensee shall observe such standards and requirements for the protection of the environment as are validly imposed pursuant to authority established under Federal and State law and as are determined by the Commission to be applicable to the facility that is subject to the licensing action involved. This condition will not apply to radiological effects since radiological effects are dealt with in other provisions of the construction permit and operating license.

14. The Commission has determined that the following activities subject to materials licensing may also significantly affect the quality of the environment:[10] (a) Licenses for possession and use of special nuclear material for processing and fuel fabrication, scrap recovery and conversion of uranium hexafluoride; (b) licenses for possession and use of source material for uranium milling and production of uranium hexafluoride; and (c) licenses authorizing commercial radioactive waste disposal by land burial. Applicants for such licenses shall submit two hundred (200) copies of an Environmental Report which discusses the environmental considerations described in paragraphs 1–4. Except as the context may otherwise require, procedures and measures similar to those described in Sections A, B, D, and E of this appendix will be followed in proceedings for the issuance of such licenses. The procedures and measures to be followed with respect to materials licenses will, of course, reflect the fact that, unlike the licensing of production and utilization facilities, the licensing of materials does not require separate authorizations for construction and operation. Ordinarily, therefore, there will be only one Applicant's Environmental Report required and only one detailed statement prepared in connection with an application for a materials license. If a proposed subsequent licensing action involves environmental considerations which differ significantly from those discussed in the Environmental Report filed and the detailed statement previously prepared in connection with the original licensing action, a supplementary detailed statement will be prepared. In a proceeding for the issuance of a materials license within the purview of this paragraph where the requirements of paragraphs 1–9 have not as yet been met, the activity for which the license is sought may be authorized with appropriate limitations, upon a showing that the conduct of the activity, so limited, will not have a significant, adverse impact on the quality of the environment. In addition, the Commission recognizes that there may be other circumstances where, consistent with appropriate regard for environmental values, the conduct of such activities may be warranted during the period of the ongoing NEPA environmental review. Accordingly, the activity for which the license is sought may be authorized with appropriate limitations after consideration and balancing of the factors described below: *Provided, however*, That such activity may not be authorized for a period in excess of four (4) months except upon specific prior approval of the Commission. Such approval will be extended only for good cause shown.

FACTORS

(a) Whether it is likely that the activity conducted during the prospective review period will give rise to a significant, adverse impact on the environment; the nature and extent of such impact, if any, and whether redress of any such adverse environmental impact can reasonably be effected should modification or termination of the license result from the ongoing NEPA environmental review.

(b) Whether the activity conducted during the prospective review period would foreclose subsequent adoption of alternatives in the conduct of the activity of the type that could result from the ongoing NEPA environmental review.

(c) The effect of delay in the conduct of the activity upon the public interest. Of primary importance under this criterion are the needs to be served by the conduct of the activity; the availability of alternative sources, if any, to meet those needs on a timely basis; and delay costs to the licensee and to consumers.

Any license so issued will be without prejudice to subsequent licensing action which may be taken by the Commission with regard to the environmental aspects of the activity, and any license issued will be conditioned to that effect.

B. *Procedures for review of certain licenses to construct or operate production or utilization facilities and certain licenses for source material, special nuclear material and by-product material issued in the period January 1, 1970—* **September 9, 1971**

1. All holders of (a) construction permits or operating licenses for production or utilization facilities of the type described in section A.1, (b) licenses for possession and use of special nuclear material for processing and fuel fabrication, scrap recovery and conversion of uranium hexafluoride, (c) licenses for possession and use of source material for uranium milling and production of uranium hexafluoride, and (d) licenses authorizing commercial radioactive waste disposal by land burial, issued during the period January 1, 1970— **September 9, 1971** shall submit, as soon as possible, but no later than (sixty (60) days after **September 9, 1971** or such later date as may be approved by the Commission upon good cause shown, the appropriate number of copies of an Environmental Report as specified in section A.1–5.

If an Environmental Report had been submitted prior to the issuance of the permit or license, a supplement to that report, covering the matters described in section A.1–5 to the extent not previously covered, may be submitted in lieu of a new Environmental Report.

2. After receipt of any Environmental Report or any supplement to an Environmental Report submitted pursuant to paragraph 1 of this section, the procedures set out in section A.6–9 will be followed, except that comments will be requested, and must be received, within thirty (30) days from Federal agencies, State and local officials and interested persons on Environmetal Reports and draft detailed statements. If no comments are submitted within thirty (30) days by such agencies, officials, or persons, it will be presumed that such agencies, officials or persons have no comments to make. The detailed statement (or supplemental detailed statement, as appropriate) prepared by the Director of Regulation or his designee pursuant to section A.8 will, on the basis of the analyses and evaluations described therein, include a conclusion by the Director of Regulation or his designee as to whether, after weighing the environmental, economic, technical and other benefits against environmental costs and considering available alternatives, the action called for is continuation, modification or termination of the permit or license or its appropriate conditioning to protect environmental values.

3. Upon preparation of a detailed statement or supplemental detailed statement as specified in section A.8 and paragraph 2 of this section B, the Director of Regulation will, in the case of a construction permit for a nuclear power or test reactor or a fuel reprocessing plant, publish in the FEDERAL REGISTER a notice of hearing, in accordance with § 2.703 of this chapter, on NEPA environmental issues as defined in section A.11, which hearing notice may be included in the notice required by paragraph 3. Upon preparation of a detailed statement or supplemental detailed statement as specified in section A.8 and paragraph 2 of this section B for

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[10] Additional activities subject to materials licensing may be determined to significantly affect the quality of the environment and thus be subject to the provisions of this paragraph.

any other permit or license for a facility of a type described in section A.1, the Director of Regulation will publish a notice in the Federal Register, which may be included in the notice required by paragraph 2, setting forth his, or his designee's, conclusion as to whether, after weighing the environmental, economic, technical and other benefits against environmental costs and considering available alternatives, the action called for is continuation, modification or termination of the permit or license, or appropriate conditioning to protect environmental values and providing that, within thirty (30) days from the date of publication of the notice, the holder of the permit or license may file a request for a hearing and any person whose interest may be affected by the proceeding may, in accordance with § 2.714 of this chapter, file a petition for leave to intervene and request a hearing. In any hearing held pursuant to this paragraph, the provisions of sections A 10 and 11 will apply. The Commission or the presiding Atomic Safety and Licensing Board, as appropriate, may prescribe the time within which proceedings, or any portions thereof, conducted pursuant to this paragraph will be completed.

C. *Procedures for review of certain construction permits for production or utilization facilities issued prior to January 1, 1970, for which operating licenses or notice of opportunity for hearing on the operating license application have not been issued.*

36 FR 19158

1. Each holder of a permit to construct a production or utilization facility of the type described in section A.1 issued prior to January 1, 1970, for which neither an operating license nor a notice of opportunity for hearing on the operating license application had been issued prior to September 9, 1971, shall submit the appropriate number of copies of an environmental report as specified in sections A.1-4 of this Appendix as soon as possible, but no later than sixty (60) days after September 9, 1971, or such later date as may be approved by the Commission upon good cause shown. If an environmental report had been submitted prior to September 9, 1971, a supplement to that report, covering the matters described in sections A.1-4 to the extent not previously covered, may be submitted in lieu of a new environmental report.

2. Upon receipt of an Environmental Report or supplemental Environmental Report submitted pursuant to paragraph 1, the procedures set out in section A. 6-9 will be followed, except that comments will be requested, and must be received, within thirty (30) days from Federal agencies, State and local officials, and interested persons on Environmental Reports and draft detailed statements. If no comments are submitted within thirty (30) days by such agencies, officials or persons, it will be presumed that such agencies, officials or persons have no comment to make. The detailed statement (or supplemental detailed statement, as appropriate) prepared by the Director of Regulation or his designee pursuant to section A.8 will, on the basis of the analyses and evaluations described therein, include a conclusion as to whether, after weighing the environmental, economic, technical and other benefits against environmental costs and considering available alternatives, the action called for is the continuation, modification or termination of the construction permit or its appropriate conditioning to protect environmental values. Upon preparation of the detailed statement, the Director of Regulation will publish in the Federal Register a notice, which may be included in the notice required by section A.9, setting forth his, or his designee's, conclusion as respects the continuation, modification or termination of the construction permit or its appropriate conditioning to protect environmental values. The notice will provide that within thirty (30) days from the date of its publication, any person whose interest may be affected by the proceeding may file an answer to the notice setting forth any reasons why the license should not be continued, modified, terminated or conditioned as proposed. Any such person may, in accordance with § 2.714 of this chapter, file a petition for leave to intervene and request a hearing. In any hearing, the provisions of section A. 10 and 11 will apply to the extent pertinent. The Commission or the presiding Atomic Safety and Licensing Board, as appropriate, may prescribe the time within which proceedings, or any portions thereof, conducted pursuant to this paragraph will be conducted.

3. The review of environmental matters conducted in accordance with this section C will not be duplicated at the operating license stage, absent new significant information relevant to these matters.

D. *Procedures applicable to pending hearings or proceedings to be noticed in the near future.* 1. In proceedings in which hearings are pending as of September 9, 1971 or in which a draft or final detailed statement of environmental considerations prepared by the Director of Regulation or his designee has been circulated prior to said date,[11] the presiding Atomic Safety and Licensing Board will, if the requirements of paragraphs 1-9 of section A have not as yet been met, proceed expeditiously with the aspects of the application related to the Commission's licensing requirements under the Atomic Energy Act pending the submission of Environmental Reports and detailed statements as specified in section A and compliance with other applicable requirements of section A. A supplement to the Environmental Report, covering the matters described in Section A 1-4 to the extent not previously covered, may be submitted in lieu of a new Environmental Report. Upon receipt of the supplemental Environmental Report, the procedures set out in section A 6-9 will be followed, except that comments will be requested, and must be received, within thirty (30) days from Federal agencies, State and local officials, and interested persons on environmental reports and draft detailed statements. If no comments are submitted within thirty (30) days by such agencies, officials, or persons, it will be presumed that such agencies, officials or persons have no comment to make. In any subsequent session of the hearing held on the matters covered by this appendix, the provisions of section A 10 and 11 will apply to the extent pertinent. The Commission or the presiding Atomic Safety and Licensing Board, as appropriate, may prescribe the time within which the proceeding, or any portion thereof, will be completed.

2. In a proceeding for the issuance of an operating license where the requirements of paragraphs 1-9 of section A have not as yet been met and the matter is pending before an Atomic Safety and Licensing Board, the applicant may make, pursuant to § 50.57(c), a motion in writing for the issuance of a license authorizing the loading of fuel in the reactor core and limited operation within the scope of § 50.57(c). Upon a showing on the record that the proposed licensing action will not have a significant, adverse impact on the quality of the environment and upon satisfaction of the requirements of § 50.57(c), the presiding Atomic Safety and Licensing Board may grant the applicant's motion. In addition, the Commission recognizes that there may be other circumstances where, consistent with appropriate regard for environmental values, limited operation may be warranted during the period of the ongoing NEPA environmental review. Such circumstances include testing and verification of plant performance and other limited activities where operation can be justified without prejudice to the ends of environmental protection. Accordingly, the presiding Atomic Safety and Licensing Board may, upon satisfaction of the requirements of § 50.57(c), grant a motion, pursuant to that section, after consideration and balancing on the record of the factors described below: *Provided, however,* that operation beyond twenty percent (20%) of full power may not be authorized except upon specific prior approval of the Commission.

FACTORS

(a) Whether it is likely that limited operation during the prospective review period will give rise to a significant, adverse impact on the environment; the nature and extent of such impact, if any; and whether redress of any such adverse environmental impact can reasonably be effected should modification or termination of the limited license result from the ongoing NEPA environmental review.

(b) Whether limited operation during the prospective review period would foreclose subsequent adoption of alternatives in facility design or operation of the type that could result from the ongoing NEPA environmental review.

(c) The effect of delay in facility operation upon the public interest. Of primary importance under this criterion are the power needs to be served by the facility; the availability of alternative sources, if any, to meet those needs on a timely basis; and delay costs to the licensee and to consumers.

If any party, including the staff, opposes the request, the provisions of § 50.57(c) will apply with respect to the resolution of the objections of such party and the making of findings required by § 50.57(c) and this paragraph. The Commission or the presiding Atomic Safety and Licensing Board, as appropriate, may prescribe the time within which the proceeding, or any portion thereof, will be completed. Any license so issued will be without prejudice to subsequent licensing action which may be taken by the Commission with regard to the environmental aspects of the facility, and any license issued will be conditioned to that effect.

3. This paragraph applies to proceedings on an application for an operating license for which a notice of opportunity for hearing was issued prior to October 31, 1971, and no hearing has been requested. If, in such proceedings, the requirements of paragraphs 1-9 of section A have not as yet been met, the Commission may issue a license authorizing the loading of fuel in the reactor core and limited operation within the scope of § 50.57(c) upon a showing that such licensing action will not have a significant, adverse impact on the quality of the environment and upon making the appropriate findings on the matters specified in § 50.57(a). In addition, the Commission recognizes that there may be other circumstances where, consistent with appropriate regard for environmental values, limited operation may be warranted during the period of the ongoing NEPA environmental review. Such circumstances include testing and verification of plant performance and other limited activities where operation can be justified without prejudice to the ends of environmental protection. Accordingly, the Commission may issue a license for limited operation after consideration and balancing of the factors described in paragraph 2 of this section and upon making the appropriate findings on the matters specified in § 50.57 (a): *Provided, however,* That operation beyond twenty percent (20%) of full power will not be authorised except in emergency situations or other situations where the public interest so requires. Any license so issued will be without prejudice to subsequent licensing action which may be taken by the Commission with regard to the environmental aspects of the facility, and any license issued will be conditioned to that effect. When

■ 36 FR 18716

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[11] In proceedings in which an applicant's environmental report, rather than a draft detailed statement, was circulated by the Commission, that environmental report shall be deemed a draft detailed statement for the purposes of this paragraph.

the requirements of paragraphs 1-8 of section A have been met, the provisions of section B.3 applicable to operating licenses will be followed.

E. Consideration of suspension of certain permits and licenses pending NEPA Environmental Review.

1. In regard to (a) proceedings subject to Section B other than those in which a hearing on an operating license application has commenced, (b) proceedings subject to section C involving nuclear power reactors and testing facilities,[12] and (c) proceedings in which the Commission estimates that construction under a permit will not be completed by January 1, 1972, the Commission will consider and determine, in accordance with the provisions of paragraphs 3 and 4 of this section E, whether the permit or license should be suspended, in whole or in part, pending completion of the NEPA environmental review specified in those sections.

2. In making the determination called for in paragraph 1, the Commission will consider and balance the following factors:

(a) Whether it is likely that continued construction or operation during the prospective review period will give rise to a significant adverse impact on the environment; the nature and extent of such impact, if any; and whether redress of any such adverse environmental impact can reasonably be effected should modification, suspension or termination of the permit or license result from the ongoing NEPA environmental review.

(b) Whether continued construction or operation during the prospective review period would foreclose subsequent adoption of alternatives in facility design or operation of the type that could result from the ongoing NEPA environmental review.

(c) The effect of delay in facility construction or operation upon the public interest. Of primary importance under this criterion are the power needs to be served by the facility; the availability of alternative sources, if any, to meet those needs on a timely basis; and delay costs to the licensee and to consumers.

3. Each holder of a permit or license subject to paragraph 1 of this section E shall furnish to the Commission, before 40 days after September 9, 1971 or such later date as may be approved by the Commission upon good cause shown, a written statement of any reasons, with supporting factual submission, why, with reference to the criteria in paragraph 2, the permit or license should not be suspended, in whole or in part, pending completion of the NEPA environmental review specified in sections B, C, or D. Such documents will be publicly available and any interested person may submit comments thereon to the Commission.

4. The Commission will thereafter determine whether the permit or license shall be suspended pending NEPA environmental review and will publish that determination in the FEDERAL REGISTER. A public announcement of that determination will also be made.

(a) If the Commission determines that the permit or license shall be suspended, an order to show cause pursuant to § 2.202 of this chapter shall be served upon the licensee and the provisions of that section followed.[13]

(b) Any person whose interest may be affected by the proceeding, other than the licensee, may file a request for a hearing within thirty (30) days after publication of the Commission's determination on this matter in the FEDERAL REGISTER. Such request shall set forth the matters, with reference to the criteria set out in paragraph 2, alleged to warrant a suspension determination other than that made by the Commission, and shall set forth the factual basis for the request. If the Commission determines that the matters stated in such request warrant a hearing, a notice of hearing will be published in the FEDERAL REGISTER.

(c) The Commission or the presiding Atomic Safety and Licensing Board, as appropriate, may prescribe the time within which a proceeding, or any portion thereof, conducted pursuant to this paragraph shall be completed.

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[12] Fuel reprocessing plants have been excluded since only one such plant is subject to section C and its construction is complete.

[13] 10 CFR 2.202 among other things, provides for institution of a proceeding to modify, suspend, or revoke a license by issuance of an order to show cause and provides an opportunity for hearing.

The effect of the Court's decision and the revised regulations was to make the AEC directly responsible for evaluating the total environmental impact, including aquatic, terrestrial, and atmospheric effects of proposed nuclear powerplants, and for assessing this impact in terms of the practicable alternatives and the need for electric power.

Accordingly, AEC licensing regulations now require that Environmental Statements contain a cost-benefit analysis which considers and balances the environmental effects of the facility and of the alternatives available for reducing or avoiding adverse effects, against the environmental, economic, technical, and other benefits of the facility. On the basis of these evaluations and analyses, conclusions are reached as to whether, after weighing these factors, the action called for should be licensing approval, denial, or appropriate conditioning to protect environmental values.

Under Section 21(b) of the Water Quality Improvement Act of 1970, the AEC is prohibited from issuing licenses or permits for activities involving discharges into navigable waters, without a certification from the appropriate Federal, State or interstate agency that there is reasonable assurance of compliance with applicable water quality standards. Accordingly, under licensing regulations, compliance with all State, regional, or Federal standards which have been established under the Water Quality Improvement Act is a minimum requirement. However, licensing responsibility does not end there.

MR. MAYO: Excuse me, Mr. Catlin. I think they are having difficulty in hearing you in the back, and it is probably the consequence of two factors: one, there is a great deal of noise in the foyer, and perhaps you might speak just a little bit louder.

MR. CATLIN: I am sorry. I have a case of laryngitis, but I will try to do better.

MR. MAYO: Thank you.

MR. CATLIN: However, licensing responsibility does not end there. The regulatory process still requires a determination, through balancing of benefits and costs of specified cases, whether or not more rigorous limits or restrictions should be applied.

Since the July 23, 1971, Calvert Cliffs decision, AEC Regulatory has issued 32 draft and 16 final Environmental Statements. Two final statements describe the environmental impacts of nuclear plants constructed or planned for Lake Michigan: Point Beach and Palisades. The summaries and conclusions regarding thermal aspects of these two plants are enclosed for the record. I have copies of the two final statements for introduction into the record.

Again, since the effects analyzed in these statements are pending before the Commission's licensing process, they do not reflect or suggest a final Commission position. They do represent, however, the regulatory staff analysis and position.

(The summaries above referred to, identified as Enclosure 2 and Enclosure 3 follow in their entirety.)

(The Environmental Statement related to operation of the Palisades Nuclear Generating Plant, Consumers Power Company, Docket No. 50-255, June 1972, published by the United States Atomic Energy Commission; and the Environmental Statement related to operation of Point Beach Nuclear Plant, Units 1 and 2, Wisconsin Electric Power Company and Wisconsin Michigan Power Company, Docket Nos. 50-266 and 50-301, May 1972, published by the United States Atomic Energy Commission are on file at U.S. Environmental Protection Agency Headquarters, Washington, D.C. and Region V, Office, Chicago, Illinois.)

Enclosure 2

Extracts from Final Environmental Statement
Point Beach Nuclear Plant
Units 1 and 2
(May 1972)

Summary and Conclusions (as related to thermal aspects of plant operation)

"This Statement is submitted in relation to the proposed issuance of an operating license to the Wisconsin Electric Power Company and the Wisconsin Michigan Power Company for the Operation of the Point Beach Nuclear Power Plant Unit 2 located in the State of Wisconsin, County of Manitowoc, near the City of Manitowoc, and includes consideration of the combined effects of Units 1 and 2. Each unit is a pressurized water reactor rated at 497 MWe using 1518 MW of heat. The system is designed to utilize a maximum of 700,000 gpm of Lake Michigan water for direct once-through cooling."

"Summary of environmental impact and adverse effects:

- No significant adverse impact on air, water, or land resources is expected.
- Minor impact on aquatic resources from possible entrainment of plankton and small fish in the intake cooling water and from temperature increases in the thermal zone of influence by effluent discharges into Lake Michigan.
- A potential adverse aquatic impact from residual chlorine if chlorine is used as an antifouling agent.
- A potential long-term aquatic impact from the discharge of demineralizer regenerant waste."

"Principal alternatives considered:

- Alternative power sources -- results in a major increase in monetary costs, an increase in the acreage of land converted to industrial use, and an increase in aesthetic impact (i.e., visual, noise, air pollution) while producing only a minor environmental benefit through reduction of heat released to Lake Michigan.
- Alternative heat dissipation systems -- results in a significant increase in capital and operating costs, an additional loss of agricultural land, and a potential for atmospheric fogging and icing while producing only a negligible environmental benefit through reduction of heat released to Lake Michigan."

"On the basis of the analysis and evaluation set forth in this statement, after weighing the environmental, economic, technical and other benefits of the Point Beach Power Plant against environmental costs and considering available alternatives, it is concluded that the actions called for are:

> The continued operation of Unit 1 under License No. DPR-24 and the issuance of an operating license for Unit 2."

Enclosure 3

Extracts From Final Environmental Statement
Palisades Nuclear Generating Plant
June, 1972

Summary (As related to the thermal aspects of plant operation)

"The present once-through condenser cooling system raises 405,000 gallons per minute (gpm) of Lake Michigan water to 25F° above ambient resulting in a thermal plume with an area of 370 acres within the 3F° excess temperature isotherm. This area represents only 0.002% of the total area of Lake Michigan. Although these thermal discharges will meet the standards set for this Plant by the State of Michigan Water Resources Commission, they will not meet the Environmental Protection Agency's recommendations for thermal discharges for Lake Michigan after December 31, 1972."

"Although thermal discharges may have localized effects such as interruption of passage of juvenile fish along the shoreline and thermal shock on spawning of certain fish, free-swimming biota are not expected to remain in the mixing zone for sufficiently long time to be adversely affected. The dominant effect will be the attraction of fish to the warm water area of the plume, especially during the winter months."

"For the most part fish and free-swimming organisms may avoid impingement or entrainment in the once-through cooling system because of the location of the intake crib, which is 20 feet below the lake surface, 6 feet from the bottom, and 3,300 feet from the shoreline, and the low intake velocity of 0.5 to 0.6 feet per second. Since zooplankton recover and reproduce rapidly, the 30% entrained and killed in the cooling water will have a minimal effect on the productivity of the lake as those killed will serve as a food base for other biota in the lake."

"The limited chlorine treatment of 1 hour per month at concentration levels of 0.5 ppm residual chlorine will reduce to a minimal level the chlorine impact on aquatic life in the vicinity of the Plant."

"Although operation of the Plant with the once-through cooling will cause an adverse effect on a small fraction of the nearby aquatic community, the impact is considered to be of little significance on the overall population levels of biota in Lake Michigan."

"After January 1, 1974, the applicant is committed, through an agreement with the intervenors in the licensing proceeding to have installed and commence operation of mechanical-draft cooling towers to reduce the thermal load rejected to the lake. The use of the towers reduces impingement, entrainment and thermal impact on fish and other aquatic biota. However, they introduce a long-term adverse impact of chemicals from continuous blowdown of 1,320 gpm of concentrated salts which would accumulate in Lake Michigan over the long-term operation of the cooling towers and cause serious degradation of the water quality of Lake Michigan in the vicinity of the Plant. The increased concentration would result in phosphate enrichment of the lake water and reconcentration of zinc and chromate in biota.'

"Cooling towers introduce terrestrial environmental impacts on flora and fauna in the dunes from chemicals deposited by the drift, evaporation of 12,320 gpm of lake water, fogging under certain meteorological conditions, and icing in the winter. Although the towers are hidden from view, they will cause an adverse aesthetic effect from the lake side and will have a noise impact on the area."

"The cooling towers will not only require an increase in capital and operating costs of the order of about $67,000,000 but will result in a decrease of about 3% in net electircal output due to the electrical power required for the fans in the towers."

"Alternatives considered were:

Heat dissipation with mechanical draft cooling towers

Heat dissipation with natural-draft cooling towers and dry cooling towers

Heat dissipation with cooling ponds and spray ponds

Reduction of thermal effects with a redesigned and relocated discharge structure

Reduction of chemical effects with a redesigned condenser cleaning system."

Conclusions:

"On balance, the staff concludes that the minimal ecological impact foreseen by operation of the Palisades Plant with once-through cooling does not provide sufficient justification for the additional increased cost to the consumer necessary to provide cooling towers inasmuch as the ecological impact of the cooling towers is minimal and comparable to that of once-through cooling. Thus, on the basis of the analysis and evaluation set forth in this Statement, after weighing the environmental, economic, technical and other benefits of the Plant against environmental costs and considering available alternatives, it is concluded that the action called for would be the issuance of an operating license authorizing operation of the facility with an once-through cooling system."

"The project before the Commission for licensing consideration, however, is one in which mechanical draft cooling towers are to be installed for operation by January 1, 1974. Since the ecological impact of the operation of the Plant utilizing the cooling towers as proposed by the applicant is comparable to that associated with operation utilizing once through cooling, the use of such towers is an acceptable action in terms of its environmental effects. Accordingly, weighing the environmental, economic, technical and other benefits of the Palisades Plant utilizing mechanical-draft cooling towers against environmental costs thereof and finding no alternatives (other than those specified as conditions below) which would materially reduce environmental damage or enhance the benefits compared to the environmental costs, the staff concludes that (despite the lower cost of the alternative of once-through cooling) the action called for is the issuance of an operating license, authorizing operation of the Plant with once through cooling prior to January 1, 1974 and with mechanical draft-cooling towers thereafter, subject to the following conditions for protection of the environment:

a. For the period prior to operation with cooling towers, the following conditions apply for protection of the environment:

    (1) The incorporation of a non-radiological, as well as radiological, monitoring program as required in Appendix B to Amendment No. 2, for the Technical Specifications to License No. DPR-20.

    (2) The performance of a monitoring program to determine:

        (a) chlorine discharges and its effects on biota;

        (b) size, shape and location of different isotherms of the thermal plume during different wind and weather conditions;

        (c) thermal discharges and their effects on spawning fish eggs and larvae and interruption of migratory paths of fish along the shoreline corridor;

        (d) impingement and its effects by counting the number, types, and sizes of fish collected on the screens and trash racks of the intake structure, and entrainment by measuring the extent of mortality and damage of biota, such as plankton, after passage through the condenser;

        (e) any changes in biota life in bottom areas of the lake, around the intake crib and the discharge canal, and onthe beach from the operation of the Plant with the once-through cooling system.

(3) Concurrent development of an affirmative plan of action for Plant operation to prevent and remedy detrimental effects on biota, to include means of reducing cold kills, chlorine discharges, and to improve dispersion of the thermal plume through an alternate discharge structure design. Such a plan shall provide for implementation so as to eliminate or significantly reduce such effects as are revealed by the monitoring program.

b. For the period that cooling towers are used, the conditions specified under a., above, plus the following:

(1) Extension of Technical Specifications to include monitoring of effects of operation with the cooling towers on terrestrial biota, including salt deposition from drift and extent of fogging and icing, and on aquatic biota from the continuous discharge of chemicals in the cooling tower blowdown in the lake.

(2) The development and use of alternate methods to effectively reduce or eliminate the amount and type of toxic chemicals as corrosion inhibitors and biocides in the operation of the cooling towers or by treatment of such chemicals to minimize the impact.

(3) An evaluation of comparative effects of the two alternate cooling systems on the environment."

R. Catlin

The Commission has utilized the services of two qualified scientific organizations -- Oak Ridge National Laboratory and Battelle Northwest Laboratories -- in preparing these statements. Several organizations have conducted or are conducting research for the development arm of AEC on generic environmental matters relating to the thermal aspects of plant siting. A list of these studies, with pertinent descriptions, and several of the full reports are also provided for the record.

(The documents above referred to follow and are identified as Enclosure 4 and Enclosure 5.)

Enclosure 4

AEC PROJECTS RELATED TO THE THERMAL ASPECTS OF POWER PLANT SITING

Thermal Plume Studies

Contractor	Project Description	Region of Study
Argonne National Laboratory	Joint studies with several utilities in Lake Michigan area of power plant siting on the Great Lakes, particularly Lake Michigan, with emphasis on thermal effects	Great Lakes
Hanford Eng. Laboratory	AEC study to apply digital simulation modeling techniques to determining the impact of power plant discharge heat on the thermal regime of all major U.S. river basins	Entire U. S.
Chesapeake Bay Institute	AEC study to develop improved models for predicting thermal plume dispersion of power plant discharges into bays and estuaries, including hydraulic modeling and field verification	Chesapeake Bay
University of Wisconsin	Joint study with University of Wisconsin and Wisconsin Electric Power Co. of the physics of nearshore circulation in Lake Michigan based upon actual measurement of lake currents	Lake Michigan
Virginia Inst. of Marine Science	Joint study with Virginia Institute of Marine Science to determine waste heat distribution and related environmental variables in the vicinity of the Surry nuclear power plant and to evaluate thermal plume predictions by existing modeling techniques	Chesapeake Bay
EG&G (Woods Hole)	Joint study with the New England Power Service Company and the Middlesex-Essex Power Pool of the forecasting of nuclear power plant environmental effects on nearshore coastal waters used for cooling, including analytical efforts and field measurements in the Gulf of Maine	Massachusetts, Maine, New Hampshire & Rhode Island

Contractor	Project Description	Region of Study
	Power Plant Siting Studies	
Holmes & Narver	Joint study with California to investigate and evaluate new and improved methods of nuclear power plant siting particularly applicable to ocean coasts	California
Johns Hopkins University	Joint study with Maryland to develop a framework for identification and evaluation of direct economic costs and external effects affecting decisions on power plant siting and design	Chesapeake Bay
	Fresh Water Biological Studies	
Pacific Northwest Laboratories	Fine structural effects of Temperature in fish	Columbia River
	Effects of Modifications on Aquatic Ecosystems	Columbia River
	Effects of Thermal Discharges on Aquatic Biota	Columbia River
	Synergistic Effects of Temperature Pollutants and Disease in Aquatic Organisms	Columbia River
Argonne National Laboratory	Great Lakes Thermal Studies	Great Lakes
Michigan State University	Dissolved Organic Matter and Lake Metabolism	Midwest
University of Michigan	A Field and Laboratory Study of Nuclear Power Plant Condenser Effects on Planktonic and Pelagic Organisms	Midwest
University of Wisconsin	Investigation of the Influence of Thermal Discharge from Large Electric Power Station on the Biology and Near-Shore Circulation of Lake Michigan-Part A: Biology	Lake Michigan

Contractor	Project Description	Region of Study
Woods Hole Oceanographic Institute	The Effects of Sublethal Temperature on the Social Behavior of Fishes	Northeast
University of Rhode Island	A Model Study of Entrainment Effects on a Striped Bass (Morone soxatilis)	Northeast
Virginia Polytechnic Inst. & State Univ.	The Effects of Temperature Shocks from Thermal Plumes on Invertebrate Drift Organisms	Mid-east
Savannah River Plant	Thermal Effects on Flowing Streams	Southeast
Savannah River Plant	Thermal Effects on the Fate of Radionuclides in Par Pond	Southeast
San Diego State College Foundation	Investigations on Physical Processes Affecting Leaf Temperature Profiles and Primary Production in the Reg Mangrove Ecosystem	Southeast
Oak Ridge National Laboratory	Thermal Enrichment Studies	Southeast
	Modeling of Populations	Southeast
	Cooling Towers	Southeast
University of Wisconsin	Microbiology of Thermally Polluted Environments - Thermal Springs Yellowstone Park	Far West

Marine Science

Contractor	Project Description	Region of Study
University of South Carolina	The Response of Estuarine Fish Embryos to Environmental Temperature Shock	Southeast
Duke Univ.	Effect of Cyclic Temperatures on Larval Development of Marine Invertebrates	Southeast
Pacific Northwest Laboratories	Bioenvironmental Effects of Effluent Discharge from Nuclear Power Plants to Coastal Waters	Pacific Northwest
Univ. of Miami	An Ecological Study of South Biscayne Bay and Card Sound, Fla.	South

Contractor	Project Description	Region of Study
U. S. Dept. of Commerce	Effects of Temperature on the Activity Feeding of Adult Atlantic Mackeral Scomber Scombrus	Northeast
University of Maryland	Biological Effects of Nuclear Steam Electric Station Operations on Estuarine Systems	East Coast
	Atmospheric Studies	
Argonne National Laboratory	Applied Micrometeorological	Great Lakes
Pacific Northwest Laboratories	Cooling Tower & Cooling Pond Atmospheric Impact	Southeast
	Cooling Tower Studies	
Westinghouse	State-of-the-Art Study of Salt Water Cooling	--
Gulf-General Atomic	Dry Tower Thermal Plume Study	--

ENCLOSURE #5

AEC RESEARCH REPORTS ON THE THERMAL ASPECTS OF POWER PLANT SITING

A. Great Lakes Studies - Argonne National Laboratory (ANL), Center for Environmental Studies (CES)

*1. Effects of Thermal Discharges on the Mass/Energy Balance of Lake Michigan, ANL/ES-1.

*2. Physical (Hydraulic) Modeling of Heat Dispersion in Large Lakes, ANL/ES-2.

*3. Thermal Plumes in Lakes: Compilations of Field Experience, ANL/ES-3.

4. A Photographic Method for Determining Velocity Distributions Within Thermal Plumes, ANL/ES-4.

*5. A Phenomenological Relationship for Predicting the Surface Areas of Thermal Plumes in Lakes, ANL/ES-5.

6. Wind Driven Currents in a Large Lake or Sea, ANL/ES-6.

7. A Compilation of the Average Depths of Lake Michigan and Lake Ontario on a Two Minute Grid, ANL/ES-10.

*8. Heated Effluent Dispersion in Large Lakes - State-of-the-Art of Analytical Modeling, Part 1. Critique of Model Formulations, ANL/ES-11.

B. James River Estuary Study - Virginia Institute of Marine Science (VIMS)

1. The Design of the Monitoring System for the Thermal Nuclear Power Plant on the James River, Special Report in Applied Marine Science and Ocean Engineering Number 16.

2. Thermal Effects of the Surry Nuclear Power Plant on the James River, Virginia, Part II - Results of Monitoring Physical Parameters of the Environment Prior to Plant Operation, Special Report in Applied Marine Science and Ocean Engineering Number 21.

C. Thermal Plume Prediction Model Development - Battelle Northwest Laboratory (BNWL), Hanford Engineering Development Laboratory (HEDL) and Chesapeake Bay Institute (CBI), The Johns Hopkins University (JHU)

*Reports provided for the Fourth Session of the Lake Michigan Enforcement Conference, September 20, 1972.

These documents are on file at U.S. EPA Headquarters, Washington, D.C., and Region V Office, Chicago, Illinois.

1. A Test Simulation of the Temperatures of the Dearfield River, BNWL-628.
2. A Test Simulation of the Temperature of the Illinois River and a Prediction of the Effects of Dresden II and Dresden III Reactors, BNWL-728.
3. Evaluation of the SIMPL-1 Hybrid Computer Concept on a Water Quality Benchmark Problem, BNWL-1228.
4. Potential Thermal Effects of an Expanding Power Industry: Ohio River Basin I, BNWL-1299.

*5. Potential Thermal Effects of an Expanding Power Industry: Upper Mississippi River Basin, BNWL-1405.

6. The Estuarine Version of the Colheat Digital Simulation Model, BNWL-1342.

7. TOPLYR - A Two-Dimensional Thermal Energy Transport Code, HEDL-TMS 71-39.

*8. Thermal Effects of Projected Power Growth: Missouri River Basin, HEDL-TME 71-180.

*9. Potential Thermal Effects of an Expanding Power Industry: Columbia River Basin, BNWL-1646.

*10. Thermal Effects of Projected Power Growth: Lower Mississippi River Basin, HEDL-TME 72-69.

11. Ocean Mixing, Technical Report 62, CBI, JHU.

12. A Preliminary Report on the Characteristics of a Heated Jet Discharged Horizontally Into a Transverse Current Part I - Constant Depth, Technical Report 61, CBI, JHU.

13. The Distribution of Excess Temperature from a Heated Discharge in an Estuary, Technical Report 44, CBI, JHU.

14. Design and Siting Criteria for Once-Through Cooling Systems Based on a First-Order Thermal Plume Model, Technical Report 75, CBI, JHU.

*15. Thermal Effects and U. S. Nuclear Power Stations, WASH-1169.

***These documents are on file at U.S. EPA Headquarters, Washington, D.C., and Region V Office, Chicago, Illinois.**

The Environmental Statements are prepared by these organizations using all available information pertaining to the site and environs. In the cases of Palisades and Point Beach, the detailed evaluations of environmental effects suggest that they are local in nature. The evaluations concluded that the adverse impacts on the local environment resulting from operation with once-through cooling would be associated with zooplankton mortality due to entrainment, possible interference with fish movement in shallow waters along the shore, and potentially toxic effects from chemical discharges. However, the statements also present the judgment that these effects were of little overall significance due to population distributions and the life habits of the important species of biota in the vicinity of each plant. Those effects attributed to thermal discharges in particular were judged to be of little significance due to the low population densities, avoidance mechanisms, and the minimal spawning areas involved. Available data indicate that those species most abundant in the general vicinity do not extensively use the beach zone during their annual life cycles. Further, the benthic organism populations in the affected nearshore areas are naturally sparse due to the type of bottom and to scouring wave action.

In the case of Palisades and Point Beach, a balancing of environmental and economic impacts from once-through cooling systems against those of alternative cooling systems resulted in the staff conclusion that the added cost of closed cooling systems was not warranted. In the Palisades case where the licensee proposed utilizing cooling towers, a favorable licensing recommendation was reached in spite of the imbalance resulting from the added cost, because the total environmental impacts were judged virtually the same for either system.

Recognizing the possibility that species composition and distribution of biota can change due to outside influences, a major condition of every final decision by the Commission to license a nuclear power plant to date has been a requirement for careful monitoring of appropriate radiological and nonradiological parameters. This is to assure the continued adequacy of the plant design to protect the environment. Such programs are on-going for those plants currently operating, and it appears that they will provide useful data from operating and proposed plants.

From a practical point of view, we believe that water quality standards for Lake Michigan are desirable and should be established within the framework of our knowledge of the lake and its ecosystems. We believe that care should be taken that any interim standards resulting from the considerations of this conference have sufficient flexibility to avoid placing undue stress on adjoining nonaquatic ecosystems. They should permit a reasoned balancing of terrestrial and atmospheric as well as aquatic impacts of proposed projects. Our basic concern is with the adequacy of the amount and depth of available research and knowledge, and the basis that presently exists for generalized rules, such as the thermal effects recommendation of last year's conference.

This evaluation of the total environmental aspects of proposed licensing actions is a Federal mandate, as I have outlined. This mandate is clearly confirmed in recent court actions providing interpretations of the National Environmental Policy Act. It is also important that water quality standards reflect the best technical information available from laboratory and field studies, which should take into account the results of pertinent monitoring programs. The standards should permit optimum use of the lake as a natural resource, recognizing its effective capacity as a heat sink as well as its utility for other purposes, including aesthetics. The standards should recognize the detail of the relationship between these effects and uses on the basis of sound scientific data.

We endorse the suggestion made in earlier sessions of this conference that a regional coordinating group, with representation by appropriate Federal, State and private organizations be established to oversee the varied research activities that are presently established or planned for Lake Michigan. The AEC, for example, supports varied research activities on the lake in addition to its regulatory activities. At the University of Michigan, the Commission supports studies on the effects of powerplant condenser effluents on aquatic organisms and research on nutrient enrichment and eutrophication of Lake Michigan. It also supports the University of Wisconsin's studies on the influence of thermal discharges from a large powerplant on the ecology of nearshore lake waters. Argonne National Laboratory carries out a varied Lake Michigan research program with primary concern for the effects of thermal and radioactive discharges into the lake. Several States and private organizations support research on various aspects of Lake Michigan. Continued evaluation of these individual programs and establishment of a mechanism for channeling their results to appropriate regulatory authority could lay the groundwork for establishing a flexible, useful and practical set of regional water quality standards.

Thank you.

MR. MAYO: Thank you, Mr. Catlin.

Are there any comments or questions from the conferees?

MR. CURRIE: Yes, I have one, Mr. Chairman.

The conclusion that was reached in the two Impact Statements mentioned was that any adverse effects would be purely local, partly because of the low populations of fish species in the neighborhood.

I wonder how this squares with Mr. Barber's findings, in the first place, that there would be an attraction of fish from the whole general area to the vicinity of the powerplant; and, secondly, that there are rather substantial fish kills that result because of that congregation.

MR. CATLIN: Well, Mr. Belter, maybe you would prefer to speak to this.

MR. MAYO: As you come to the podium, please introduce yourself.

MR. BELTER: My name is Walter Belter, AEC, Division of Environmental Affairs.

The results of these analyses of the two Impact Statements that you make are concerned with attracting fish to the discharge structures. Of course, this is a known fact insofar as any powerplant discharge structures are concerned. The analyses that were made by our staff, however, did not indicate or was not able to reveal any type of information on Lake Michigan as far as present powerplant sites were concerned that have shown this fish kill phenomenon.

I think, as Mr. Barber has indicated, much of the data is very scarce or lacking insofar as Lake Michigan plants are concerned, and our ecologists' evaluation of the data that we have available -- and as I am sure you are aware, in these statements there are hundreds of references indicated -- we were not able to find informational data to back up the concern for that part of it.

MR. CURRIE: You are familiar with the data that Mr. Barber has given?

MR. BELTER: Yes. As far as I know, the staff who evaluated both of the two plants that the Environmental Statements mentioned here, are aware of the data that Mr. Barber has stated. Mr. Barber did give a lot of information that I think would be worthwhile having time to digest, such as Mr. Purdy has indicated.

We are aware of fish kill data very much so at intake structures, and the data that he quoted certainly at Indian Point is one of the primary concerns, I think, of the Atomic Energy Commission and the whole power industry. Intake designs are certainly a science, at this point in time, that is not really developed, and there are, of course, indications of massive fish kills at certain plants. This is not just for nuclear powerplants but for all types of steam electric systems.

MR. CURRIE: Yes. Well, I would like to refer to one case that Mr. Barber mentioned, on page 10 of the report, where he talks about January and early February 1971 at the Consumer Power Company's Campbell plant on the eastern shore of Lake Michigan, several hundred thousand fish had been killed by impingement.

MR. BELTER: Which is an existing fossil fuel plant, correct?

MR. CURRIE: That is my understanding.

MR. BELTER: Yes.

MR. MAYO: Are there questions from any of the other conferees?

MR. McDONALD: Mr. Catlin, in regard to the bottom of page 5, top of page 6 of your statement, you talk about your monitoring program. Do you have available for submission to this conference the complete details of your monitoring program from each plant that you have licensed?

MR. CATLIN: We can certainly make these available for the record.

MR. McDONALD: I think this would be helpful if we could receive this during the next week while the record is open, Mr. Catlin.

MR. CATLIN: We would be happy to do so.

MR. BELTER: I might just add to that point: Those monitoring programs are an integral part of the technical specifications for those plants and, as such, have been prepared and are part right now of the hearing procedures that are going on in both of these plants; so the detailed monitoring specifications are available for both of the plants. And, as Mr. Catlin stated, they can be made available readily to the conferees.

MR. McDONALD: Have the monitoring requirements been prepared by the applicant?

MR. BELTER: The usual procedure on the preparation of the technical specifications, both for radiological and nonradiological specifications, are prepared in a draft form by the applicant. They are then reviewed by the Commission and its staff, similarly to the review of safety reports. And only after usually very extensive review, discussions, and dialogue concerning these specifications are they then written up by the AEC and it then actually becomes a technical specification of the Commission.

MR. McDONALD: Do you have a set of criteria against which you review the monitoring requirements, and do you make these criteria available to the applicant if you do have them?

MR. BELTER: Right offhand -- there are safety guides that are being prepared -- a number of them have been issued by the AEC. I believe they are up in the twenties right now. One of these safety guides has to do with criteria for radiological monitoring of nuclear powerplants. This has been published and is readily available,

Criteria for nonradiological aspects of powerplants are at this point in time just slowly being developed. In fact, the preparation of nonradiological specifications has only begun here with the detailed preparation of the Environmental Impact Statements, which has taken place here since the Calvert Cliffs decision and really only over the past year.

So those, at the present time, will be different, I would say, for individual plants, depending again on the location and the specific environmental characteristics of each of the plant sites. These specifications that I have seen anyway are not in that regard standardized but are more in the position of being developed -- an involvement type of specification.

MR. McDONALD: Are those individual criteria available?

MR. BELTER: Yes.

MR. McDONALD: I wonder if those could also be made available?

MR. BELTER: As part of the safety guides pertaining hereto, monitoring can be made available to the conferees.

(The following documents were submitted by the AEC and have been accepted as exhibits on file at U.S. EPA Headquarters, Washington, D.C., and Region V Office, Chicago, Illinois:

A. For Palisades Nuclear Powerplant

1. Radiological and Nonradiological Technical Specifications
2. Environmental Monitoring Program
3. Administrative Controls, Including Reporting Requirements

B. For Point Beach Nuclear Powerplant, Unit No. 1 and Unit No. 2

1. Technical Specifications
2. Appendix B to Facility Operating License DPR-24 and DPR-27)

MR. McDONALD: In terms of the Environmental Impact Statements that AEC prepares or has prepared for them -- specifically Palisades and Point Beach -- have independent technical field studies been conducted to support these statements by AEC?

MR. BELTER: The separate independent field studies -- right now, this is a part of the AEC's program on Lake Michigan, and our principal contractor, at this point, is Argonne National Laboratory. And during the past 2 to 3 years, Argonne National Laboratory has been conducting analytical, laboratory, and field studies on the lake, and most of their efforts so far, on the lake, have been devoted -- as far as one plant is concerned -- to the Point Beach plant.

They have also been involved in part of the Waukegan studies and also for the University of Wisconsin studies out of Milwaukee, which is below a fossil fuel plant located on the lake.

So that the answer to your question is that we are definitely trying to follow up these statements here with the detailed field studies that were recommended as a part of the last session of the conference, and which was, as a part of our statement, we felt, highly essential that at least somewhere in the range of 5 years of field studies be carried out in order to determine what the effects of these plants would be on Lake Michigan.

MR. McDONALD: If AEC grants a full operating license to, say, Point Beach, and if as a result of the monitoring that takes place at Point Beach substantial damage is uncovered to the aquatic environment, would AEC, then, conduct hearings on the desirability of backfitting that plant?

MR. BELTER: I don't know whether I can give a categorical answer to that question.

In the environmental reviews and assessments that have been made, I would say most of the conclusions were, in the statements, that if a deleterious effect is found through the operation of the plant in question, it will be necessary for the applicant to take the action required to remedy that effect. That is a standard recommendation, and actually usually it is a conditional part of the technical specifications that this type of action will have to be taken if harmful effects are found.

MR. McDONALD: Well, what criteria guidelines has AEC developed that would enable AEC to measure whether such deleterious effects have indeed taken place on the basis of monitoring information that might be available?

MR. BELTER: I would say on something like that, this conclusion of deleterious effects would be developed in conference with the various groups that are involved in the monitoring operation. In other words, the AEC, in concert with the involved States, with EPA, and with other appropriate Federal agencies, would determine what these deleterious effects are. It would not be a separate action whatsoever by the AEC, but it would be an action or a decision or a conclusion that would be reached in conference with the appropriate State and Federal agencies involved.

MR. McDONALD: What would be the mechanism for this? This statement you just made is somewhat new information as far as I am concerned personally anyway.

Is there in the offing a mechanism that would be developed to make this assessment?

MR. BELTER: Well, in the cases of the technical specifications that I have seen, as a part of these Environmental Statements and as a part of the licensing process, the monitoring operations -- reports of these operations are provided to all of the involved agencies and groups pertaining to that site or that plant. There will be meetings that are usually specified, again, in the specifications on some type of a time framework, that call for discussing the results of the plant operations.

In other words, all of the data that is collected in the monitoring programs will be reviewed by these agencies and, if there are any effects pointed out as a result of these operations, it then would be the intent of the Commission to take the action as called for, as a result of the monitoring and the meetings of the involved organizations.

MR. McDONALD: Well, I believe, sir, what I am driving at is this: We find ourselves now at a state where there are a number of views on what constitutes damage or whether, in fact, there is any damage. And it would seem to me that if AEC grants a license to, say, Point Beach, or any other facility on the lake, that there should be some rather definitive guidelines on what would constitute either a revocation of that license or damage to the environment, or what would constitute a very clear case of affirmative action to remedy that deficiency within a given period of time. Or else, when we get to the matter of damage, I think we may be right back where we are right now.

MR. BELTER: Well, without attempting to preempt what any kind of decisions would be in these hearing processes involving the plants in question, I would say that the AEC is looking for any kind of help or guidance that we can obtain from any Federal or State agencies in regard to what constitutes damage below the plants. In the preparation of the nonradiological technical specifications, there has been serious efforts taken to try and come up with what would be damage below the plants. For example, one of the most sticky problems, or the roughest ones to handle is: What constitutes an acceptable fish kill below a plant or at an intake structure above the plant?

We realize that in these cases fish have been killed, but the overall question is: What effect does it have on the total population of these various species in that situation? If one fish dies and you count that, perhaps maybe that would not be too damaging. If it was perhaps maybe a carp or a sucker, maybe that wouldn't be too, too harmful. If 5 fish die, if 500, 1,000, 100,000 -- what is considered to be an acceptable number to the regulatory agency?

And we have had many discussions with many different ecologists around the country, with various agencies, attempting to come up with an acceptable number, so that it could be included in the specifications as a point for taking corrective action. And I will say, at this point, that we really haven't arrived at any kind of an acceptable number.

The same thing, I think, can be carried to impingement on the intake screens, on the entrainment of organisms going through the condenser. Is there any kind of acceptable numbers in terms of what the overall population is? We are well aware that -- and you will hear further today, too, the numbers and percentages of various species -- zooplankton and that -- that are killed going through the condenser. These numbers will vary all over the place -- 10 percent, 20 percent, 30 percent -- Mr. Barber has given numbers up to 90 to 100 percent.

I think the basic issue here though is: What effect does this type of entrainment kills have upon the total population surrounding the plant? And from what we have been able to determine, from the ecologists who have evaluated it, in the AEC assessments, we have not been able to determine that there has been an overall decrease in these essential populations making up the total ecosystem.

So these are areas that we are looking for, for guidelines in terms of how you can specify this type of thing in the technical specifications for the plant operation. And if there is anyone here, in the various States or Federal agencies involved that can assist us in this regard, we would be most pleased to have that type of consultation.

MR. McDONALD: Well, I think we are talking on the same thing. I appreciate the extent of your remarks, and I will close off my questioning by, again, restating: I think the imperativeness is having criteria by the time a license is granted, if that facility goes forward without adequate cooling facilities.

MR. BELTER: I might ask the same kind of a question, Mr. McDonald. Has the EPA in its various programs of research and monitoring come up with any draft criteria that you would consider could be used by an agency like the AEC in its licensing process that would indeed define damage and the other types of criteria that you consider important in terms of plant operation?

MR. McDONALD: We are doing this, under our Refuse Act Permit Program, so that we will be able to detect what a violation is, and I think this matter really has to be pursued.

MR. BELTER: I agree.

MR. MAYO: Any other questions, gentlemen?

MR. FETTEROLF: Yes.

Mr. Belter, one of your senior scientists involved in determining how you assess the environmental impact is Dr. Charles Coutant, is that correct?

MR. BELTER: Yes.

MR. FETTEROLF: And while Dr. Coutant was undergoing the throes of working through what you have just discussed about how you evaluate biological damage -- whether it is on the basis of individual organisms killed or whether it is on the total impact to the population -- he was also serving on a committee with the National Academy of Sciences, which was made up of the outstanding aquatic scientists throughout the country, and they helped him and he helped this other committee.

I attended all of these meetings, and I know the pangs they went through in trying to reach a correct decision. And, as an example of where literally millions of larval fish can be killed and yet apparently not influence adult populations, I would refer to Mr. Barber's report, where he cited the work of Marcy at the Connecticut Yankee Plant, where some 85 to 90 percent of the fish were killed.

Now, I believe a followup to Barton Marcy's work was that a cost-benefit report was turned in to AEC on what was the value of those fish that were killed. Do you recall the results of that report?

MR. BELTER: Which plant is this?

MR. FETTEROLF: This is Connecticut Yankee at Haddam Neck, Connecticut.

I heard Mr. Marcy give this report at the Westinghouse International School for Environmental Management in Colorado this summer and, on the basis of the larvae that were killed going through the plant and the larvae going down the Connecticut River outside of the plant, and on the basis of the populations that returned, the value of the fish killed was $131.

MR. BELTER: Is that right?

MR. FETTEROLF: Something like that; something in that neighborhood; and that was on an annual basis.

Now, I am a defender of the environment, but I want to put these figures in perspective, and I would like to leave the record open so I can check with Dr. Marcy that this was the value assigned to these fish.

MR. BELTER: My only comment, Mr. Fetterolf, to that statement is that, at this point in time -- and I don't recall the names of the total 32 draft Environmental Statements that have been prepared and the 16 final Environmental Statements -- but I do not believe that the Environmental Statement for that Connecticut Yankee Plant has been prepared or issued at this point, primarily because it was listed down lower in the list of the total number of statements that had to be prepared. Over a year ago, a decision had to be made on which statements would be prepared first, and the critical list that was prepared at that point, consisting of around 10 or 11 plants that were most critical from a potential power shortage standpoint around the country -- those statements were given the initial attention of the Commission staff. Then there were other ones listed in descending order of priority being prepared and, to the best of my knowledge, I do not believe the Impact Statement for the Haddam Neck plant has been issued.

MR. FETTEROLF: Perhaps this was simply a special study.

MR. BELTER: Well, I can verify that for you very easily.

MR. MAYO: Are there any other questions, gentlemen?

MR. BRYSON: I do have one question, Mr. Mayo.

On page 4 of your statement and also page 5, where you are talking about imbalancing of environmental and economic impact, can you elaborate somewhat on what you mean by that comment? Are you considering environmental impact in the immediate vicinity of that plant, or do you include environmental impacts on the Palisades plant and its effect on the lake in conjunction with effects that may occur from the Cook plant, from Zion, Point Beach, Kewaunee, and so on? Is it strictly a local consideration, or do you consider regional implications?

MR. BELTER: Most of the considerations, at this point in time, have been on a -- I would say -- localized basis.

Now, I don't believe that in the statements that have been included heretofore in the record, there has been pointed out any discussion in terms of evaluation of the potential effects, say, of the Cook plant or other plants. That assessment was more comparing the alternative types of cooling systems -- for instance, the once-through system as compared to various types of auxiliary -- cooling towers, spray ponds, other types of ponds -- and comparing the differences there as far as total impact that would be involved in the discharge of blowdown, possible atmospheric effects that would involve icing and fogging with cooling towers, the noise problem, and comparing that with the once-through effects on the aquatic ecology.

But as far as the impacts of these plants or the effects on a regional basis, all of the information we have been able to obtain so far is that these impacts or effects will not be anything more than on a localized basis -- and by "localized," I would hate to put a number on it, but I would imagine it would be somewhere in the range of, say, 5 miles or 10 miles, that any effect or impact of that plant, per se, would be essentially nil beyond that distance.

So this, I believe, is the reason why there has not been any further consideration given to evaluation on a larger scale insofar as Lake Michigan plants are involved.

MR. BRYSON: Mr. Currie made reference to

Conclusion 17 of the conference and the remarks by Mr. Barber concerning the fact that these effects may not be strictly local in nature. So I still -- while I think you have answered my question, it appears that AEC does just look at the local situation and you do not relate any evidence of the fact that they --

MR. BELTER: Well, let me qualify that a little bit.

If, in the analysis, it was determined, say, that potentially the impact or effect would be at a point 3.5 miles or 5 miles from the plant, then an assessment would be made of -- if there was, say, another plant there -- what that effect would be.

But in the cases of these plants here that we have mentioned, there was no effect or impact determined; so, therefore, there was no further assessment mentioned in the report.

MR. MAYO: Any other comments, gentlemen, or questions?

If not, thank you very much, gentlemen.

We will recess for lunch and reopen the session at 2:00 p.m.

(Noon recess.)

THURSDAY AFTERNOON SESSION

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MR. MAYO: May we have your attention, ladies and gentlemen? There is a need to get started again as soon as we can.

We are back in session, ladies and gentlemen.

In keeping with the published agenda, the first State presentation and the presentation of public statements related to the individual States will be by the State of Indiana.

Mr. Miller.

MR. MILLER: Thank you, Mr. Chairman.

As we indicated this morning, the State of Indiana does not have a statement on the thermal question, but we do have several people who would like to speak on this subject, and I would now like to call on Ted Falls of the Izaak Walton League.

STATEMENT OF TED FALLS,
PORTER COUNTY, INDIANA, CHAPTER,
IZAAK WALTON LEAGUE, WHEELER, INDIANA

MR. FALLS: Mr. Mayo, members of the conference, ladies and gentlemen.

MR. MAYO: Excuse me, Mr. Falls. Would you be kind enough to lower the mike, please, sir?

Thank you very much.

MR. FALLS: My name is Ted Falls. I am a member of the Porter County, Indiana, Chapter of the Izaak Walton League, and am active in the Indiana Division and the National Izaak Walton League. I am also active in the Lake Michigan Federation.

I am a retired research development engineer. My major work was in hydraulics. I have been a life-long amateur naturalist and a spare-time scholar of biology. I think I have carried much of the discipline of my profession into my hobbies. With this background I think I might attempt a few constructive comments.

I have recently studied in detail Dr. Donald W. Pritchard's paper "Temperature Standards for Lake Michigan," given before you in the fall of 1970. In this paper, Dr. Pritchard has explored the condition of the plume discharging cooling water from powerplant condensers for velocities of discharge from essentially zero to a value that purports to mix the plume with lake water successfully to a temperature of 1° above lake ambient. The case for maximum mixing, Case IV, has been applied to the system planned for the Zion plant of Commonwealth Edison Company, with some modification.

I have the highest respect for the engineering work Dr. Pritchard has done, and I think he will have the respect of every engineer that reads him with comprehension. I have applied a number of tests within my present scope and find him consistent.

The alteration at Zion is important. Dr. Pritchard describes Case IV with an orifice 15 feet wide and 10 feet high discharging into 10 feet of water. The jet immediately fills the whole depth of the lake. At Zion, the jet is designed to discharge in a sheet about 75 feet wide and 3 feet deep, at the bottom of the lake in 12 feet of water. This provides additional surface of contact with lake water for the first step in mixing with lake water. The jet stabilizes through the whole depth of the lake at about the 12° isotherm, as near as I can tell from reading Dr. Pritchard's data. Beyond that, mixing with cold lake water must be made wholly at the sides of a broad body of warm water.

The jet discharges a volume of 1,705 c.f.s. at the nozzle, or 141 acre-feet per hour, an easier figure to handle. At the 12° isotherm it has taken up 94 acre-feet, which may be reasonable. Between the 12° and the 1° isotherms, 2,575 acre-feet must be taken up through the sides. This seems optimistic, considering the narrow area of the sides between the lake surface and the bottom, and the fact that much of the essential kinetic energy in the jet is being spent against viscosity in the turbulence between the jet and the cold lake. We do not have any means to test this analytically. This, however, is the essential point for my objections in my previous statements.

Another factor with the wide Zion jet is the extent of the interface at the bottom. This is a region of high turbulence, and it is persistent the whole length of the jet. Energy is dissipated in turbulence both as storage in heterogeneous velocities in heterogeneous directions and as work against viscosity. At the bottom it can have no part in mixing. The rate at Zion will be in the order of 5 times the rate in Case IV. For this reason, we are skeptical of the apparent proportionally longer plume at Zion. We hope the Zion jet has been examined in the tank.

There is a serious objection to the second jet 308 feet away from the first at Zion. In still water there will be no interference. But with any current, the two will combine producing a plume up to double the size of one.

In still water, the system will "clog." With a continuously operating jet, the field beyond the region of decaying turbulence will be taken up as lake water. This will have a continuously increasing temperature, enlarging all areas of the plume. This condition exists in the lake at times.

A cross-current is essential to maintain a supply of cold lake water for the continuous successful operation of the process. Dr. Pritchard limits the cross-current to 10 percent of the initial velocity (according to Policastro and Tokar, "Heated-Effluent Dispersion in Large Lakes.") For Zion, this limit would be 10 percent of 9 feet per second, or 0.61 m.p.h. -- that is about a half a knot. Lake currents sometimes exceed this velocity.

We recently flew over the mouth of the St. Joseph River, Michigan, when there was a north-flowing current in the lake. The river was markedly colored. The interface of the two streams was sharply marked for a long distance. This indicates a total absence of interchange of water between the two streams. We do not know the relative velocities of the two streams, nor did we measure the distance before turbulence began the process of mixing. It is widely known that acceleration of a stream in a pipeline damps out turbulence. Apparently transverse acceleration does the same thing. Since turbulence is the essential factor in mixing, the plume will enlarge as the result of many current velocities.

T. Falls

Commonwealth Edison states that the jet velocity at the nozzles will be about 9 f.p.s. at "full load operation." And I quote that from their statement. This implies that the pumping rate may be reduced for lighter loads to maintain the discharge temperature at 20° over the lake. This may well be, for the pumping costs are high and perhaps exceed the savings for working the turbines at the possible higher efficiency of reduced condenser temperature. The plant will operate normally at about 90 percent rating. This, with the pumping reduced, will result in a 10 percent reduction of the heat discharges and a 19 percent reduction in kinetic energy at the nozzles. At 80 percent rating, the figures will be 20 percent reduction of heat and 36 percent reduction of kinetic energy. The consequence will be larger areas within the isotherms of the field.

We suspect that both Commonwealth Edison and Dr. Pritchard have submitted the data for maximum performance, without regard to the adverse effect of variations.

Heat transfer to the air within the 1° isotherm, for both Zion and Case IV, appears to be between 2 percent and 3 percent of the total heat contained in the discharge. This means that 97 percent to 98 percent of the heat discharged passes the 1° isotherm. The heated water fills the lake at this point, or very nearly so. The rate of rise due to buoyancy at 1° is very low. An estimate of heat dissipation to the air, according to the rate used by Dr. Pritchard for a moderate condition, indicates that the body of water between the 1° and the 0.5° isotherms will have an extent of 25 to 100 square miles.

Due to lake currents, this far field affects primarily the inshore waters. It creates a climate equivalent to a move of several degrees of latitude southward. It becomes the ambient temperature above which neighboring plants raise their discharges. The inshore temperature raises progressively by this process.

We question the superiority of the Case IV high velocity jet. At Zion, the estimate for the area within the 1° isotherm is 1,260 acres, nearly 2 square miles. Originally, the outfall for the Cook plant at Bridgman, Michigan approximated Case I. For this, the area within the 1° isotherm is about 6 square miles. (I am using Dr. Pritchard's projections.) But Zion dumps 97 percent to 98 percent of its heat into the lake beyond the 1° isotherm; the Cook plant dumps only 10 percent to 15 percent. The recent alterations to the Cook discharge system are a disadvantage in this respect.

Meandering of a long plume has been reported frequently. The consequence is the detachment of large bodies of warm water. This has been observed and mapped at the Bailly fossil-fueled plant in Porter County, Indiana, and is reported in the "Environmental Report for Bailly Nuclear 1" to the AEC, and in the "AEC Environmental Report" for the same plant. Quantitative studies of the plumes at Zion and other plants must take these detached bodies into account.

The Kewaunee flume discharging at the shoreline of the lake is unforgivable. It is well documented that this form has the greatest adverse consequence to the near-shore.

I have the greatest sympathy for an engineer's desire to test his work against the full-scale working system. On the other hand, the outfalls at Zion, Cook, or Kewaunee will not be discontinued for another method if the actual hydraulic performance fails in its promise on the diversity of working conditions, and especially if it is found that there is a grave impact on the ecology of the lake.

I want to say some more on the biology, but before I leave this I would like to make a point that I did not include in my paper. That had to do with the point that I made that there is a high level of turbulence between this jet located at the bottom of the lake and the jet itself.

T. Falls

The dynamics of flow are such that that jet is perpetuated and enhanced until it becomes one of the major sources of dissipation of energy.

But there is another point here that I think is apropos, but I did not include it in my paper because when I wrote it I was not so sure, and that is that this turbulence under the jet has a very high scouring action and will dig a trench in the sand for a very considerable distance beyond the jet. If we look at Dr. Pritchard's dimensions, it is going to be of the order of a mile or more.

Now, I want to draw a conclusion that comes from what I observed along the Indiana shore at Michigan City. That trench is going to be costly to the beach because of the effects of erosion. The jet will pick up and carry any sand away that is carried into the trench and the sand will be continuously taken away from the shore due to wave action. And I would suggest that we should thoroughly investigate this effect before we permit the Zion plant to operate with this outfall, otherwise it is going to cost the park up there at Zion at Sunny Beach.

Now, this has happened at Michigan City where they dug a channel into the harbor there to the east -- slightly north of east -- of the channel. There is an entrance there. That was done 2 years ago.

At the time that was done, there was a beach that must have been 100, 150 feet wide, due to the accumulation of sand that had been swept down from up the lake and had formed a filler. Today that is completely gone and there is deep water against the bulkhead, and that has gone down into the channel which was dug.

I have pictures to substantiate this from 2 years ago and now. I had not expected at the time I took them -- not even when I took the last pictures --it was when I viewed them that I realized that the beach was gone.

MR. McDONALD: Do you have those pictures, Mr. Falls?

MR. FALLS: I didn't bring those pictures. I did bring some pictures showing the sharp interface between the lake current and the discharge at the St. Joseph River. I wasn't sure I would be able to use them. I tried to write a description so that it wouldn't be necessary to show them. But I did bring them and I can supply some pictures of Michigan City, too, if you like. They are color slides and they don't reproduce very well in black and white.*

Certain biological studies submitted to this conference and to other bodies responsible for making regulations are entirely inadequate. The power companies responsible for making these studies apparently do not avail

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*(The pictures were submitted following the conference and follow this page.)

Wheeler, Indiana 46393
October 2, 1972.

Mr. Glenn Pratt, Enforcement Division,
US Environmental Protection Agency, Region V,
One North Wacker Drive,
Chicago, Illinois 60606.

Dear Mr. Pratt:

Enclosed are five sets of photographs pursuant to the suggestion of Mr. Francis Mayo. They are supplemental to my statement of September 21 1972 to the Four States Enforcement Conference. They are strictly for the record. One could hope for clearer pictures, but the details in question can be perceived with careful examination.

I have included a text for the remarks in addition to my written statement. With references at hand I am able to be more specific in one or two matters.

Yours respectfully,

Ted Falls.

Ted Falls.

SUPPLEMENT to Statement to Lake Michigan Enforcement Conference
by Ted Falls, September 19-21, 1972.

To follow discussion of the hydraulics of the plume, page 3.

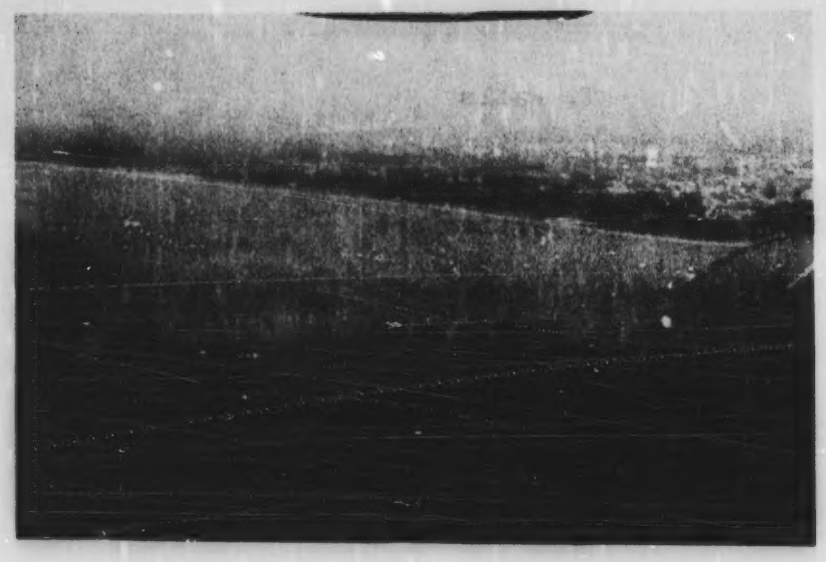
In view of the breadth of the discussion that has gone before, in this Conference, I would like to add a point that I deleted from my prepared statement for the sake of brevity.

I have spoken previously of the high turbulence between the jet and the bottom of the lake at Zion. This turbulence will scour a channel in the sand. The depth and length of the channel depends on the initial velocity of the jet at the nozzles. All sand that might be drawn into the channel will be picked up and carried out into the lake.

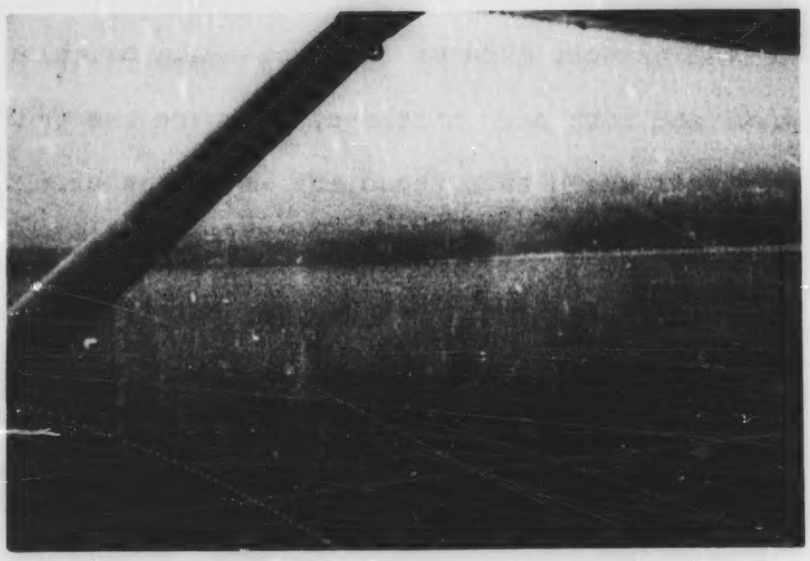
Due to wave action, the sand between the jet and the beach will flow into the channel to be carried away. The inevitable result will be the destruction of the beach at the plant, and in a short time, the reduction or complete loss of the beach at the adjacent State Park.

This effect has occurred at Michigan City (Ind.) Harbor, at the mouth of Trail Creek. In early 1970 a cargo ship that tried to enter the Harbor at the east entrance ran aground. By June, that year, the Army Engineers completed dredging a channel through the entrance, approximately 1000 ft. offshore. At the time there was a wide beach along the bulkhead at the small boat harbor, with the characteristic fillet against the jetty that makes the major harbor.

By July 1972, the beach had entirely disappeared. We can only presume that the beach sloughed off into the channel.



7/9/72. Mouth of St. Joseph River, St. Joseph, Mich Sharp demarkation between river outfall and northward lake current.



7/9/72. Demarkation continues great distance beyond mouth of river. Note extensive mixing on shore side of plume. This was more marked to the naked eye.

themselves of sophisticated authority in planning the work. I will cite two studies in particular:

1. "Benton Harbor Powerplant Limnological Studies" made by Great Lakes Research Division, University of Michigan. This was a study of relatively undamaged lake biota, preliminary to the operation of the Cook plant.

A study in the surf and immediately adjacent waters was neglected on the supposed absence of life there. *Cladophora* appears in this region on the shores of Indiana below the outfall of the Michigan City plant of NIPSCO, presumably due to the rise in mean annual temperature.

No studies were made of fish spawn and hatchlings over the gravel and rock beds offshore, nor were the beds mapped. It is well known that these are important breeding areas for fish important to the ecological structure.

2. "NIPSCO Environmental Report, Bailly Nuclear 1," to the AEC. This makes the most frank report of the impact of a heated plume on the marine ecology of any I have come across. The plume discharges at a maximum of 14° above ambient.

It shows increases in the plume of a number of species of algal types and invertebrates and the disappearance of others. It particularly notes a serious fungal infestation of *Burytemora* and *Daphnia*, absent in the surrounding lake.

The study was limited to 3 days in October. This is not the season of major impact.

It covers only one element of biota quantitatively.

It disregards -- or fails to report -- the temperature at the point of sampling. By averaging, it conceals the effect of temperature in relation to multiplication or disappearance of species. There is no possibility of evaluating Dr. Pritchard's proposals to release large quantities of water 1° over ambient from this work.

The plume must be studied throughout the season. You must know how much the algal bloom and the increase of invertebrates is advanced before the normal season, and how much it is extended beyond. You must know the increases during the normal season.

The increase of plankton adds to the organic detritus in the lake. This enhances the support and the multiplication of living organisms in the long run. This is acceleration of eutrophication in the lake.

To my knowledge, at this writing, no study has explored the phenomenon of the concentration of predator fish at thermal plumes, with their marked disappearance after several weeks. We can conjecture the cycle: the increase of plankton attracts and concentrates the forage fish; the concentration of these attracts the predators. There are two likely factors in the concentration of the vertebrates:

1. The increased temperature raises the metabolism rate of the cold-blooded species. This may be attractive.

2. The increased temperature increases the food supply. We suspect this to be the greater force.

The predators and the prey fish must come from other parts of the lake. How wide an area supplies the prey fish?

The disappearance of the predators would indicate the possible decimation of the prey. If this is true, what is the consequence to the biological balance of the system?

Two points are presented before you that are invalid:

1. Statements of the impact of thermal discharges on the lake as a whole are deceptive to only the uninitiated. The impact is on the inshore waters.

2. Emphasis on the existence of natural limited bodies of water in the lake of comparable temperature differences is equally untenable. Thermal plumes add to these areas in major quantities as I have mentioned above. They increase the effects of temperature beyond the natural

balance.

Evaluation of the issues before you falls into two categories: 1) the ethical, and 2) the economic. To try to evaluate them on the same plane is adding apples and oranges.

The ethical decision must be cleared first. Do we want to proliferate heat discharges into the lake until damage becomes obvious? In Lake Michigan there will be no return in our lifetimes if we exceed the tolerance of nature here. The lake is valuable to people as well as to industry.

The true economic decision is in the balance between a lakeside site, with the use of the lake for cooling water, on the one hand; and, on the other, an inland site using less critical resources for cooling. Granted, the cost to the consumer may increase somewhat. The economy is more flexible than the lake.

Thank you.

MR. MAYO: Thank you, Mr. Falls.

Do the conferees have any questions or comments?

MR. McDONALD: I would like to refer to page 4, Mr. Falls, on your comment on the Bailly Report as "the most frank report of the impact of a heated plume on the marine ecology of any" that you have come across.

You mean this in what way now?

MR. FALLS: I am speaking primarily of the reports to bodies like yourselves that have a decision to make that are produced by the required studies by the people who would suffer by adverse reports. Frankly, directly, I mean the power companies are turning in what appear to be very weighted reports -- weighted by neglect of some of the essential factors that I have discussed.

MR. McDONALD: Well, I was interested to see that comment because when I read the Bailly report, I had the same feeling that you had. It was a very frank report; it laid out the situation that happened and was most informative.

MR. FALLS: Yes.

MR. McDONALD: The thing that I would like to pursue just a moment is: Are you suggesting in the items below, where you discuss the Bailly report, that the situation -- despite the frankness of the Bailly report -- is much worse because of the limited duration of the study?

MR. FALLS: That is true. I think they failed -- at least they did not pick the time that revealed the worst to permit an overall picture of what would happen throughout the thermal site.

MR. McDONALD: I would like to thank you for a very detailed and very informative statement.

MR. FALLS: Thank you.

MR. McDONALD: I think it is refreshing to get this type of statement from a man who is a member of this group.

MR. MAYO: Any other questions or comments, gentlemen?

Thank you, Mr. Falls.

MR. MILLER: Thank you, Ted.

The next person I have to call on is Mrs. L. E. Bieker. It appears that she is not here.

We have a statement from Sylvia Troy, who is not here, but Jim Jontz from the Lake Michigan Federation will read Mrs. Troy's statement.

STATEMENT OF JIM JONTZ, PRESIDENT,
INDIANA ECO-COALITION,
VALPARAISO, INDIANA

MR. JONTZ: My name is Jim Jontz, J-o-n-t-z. I would like to submit two brief statements on behalf of citizens that are not able to be here at the conference proceedings today. In addition, I think we could find Mrs. Bieker's statement if you don't have a copy.

Mrs. Troy's statement is presented for the Save the Dunes Council.

Mrs. Florence Dale has also prepared a statement which she would like to introduce into the record as an individual.

I would like to take just a few seconds more than that to explain some of the concerns of the individuals who were not able to be here today.

Both of these statements -- I should say the general feeling among many citizens in Indiana is that they would like to indicate their concern to the conference that action be taken to protect Lake Michigan from thermal discharges as quickly as possible.

We do not have expertise, in many cases -- when you stated previously -- I believe it was Mr. McDonald -- about the quality and the nature of the statements from environmental groups -- I hope that we are not looked to for expertise, but we do have experience in some of the other facets that are important in deciding these decisions.

MR. McDONALD: Well, just to clarify that I did not mean that in any sense to mean that every statement from an environmentalist group had to be a technical statement. But I think this statement by Mr. Falls was an unusual statement because I know how difficult it is to get the expertise that is often required to make statements on behalf of environmentalists. He happens to be a technical man and I think he has put his technical knowledge to good use.

MR. JONTZ: We certainly agree with you that we wish more of us could make statements like Mr. Falls'.

The comments we have just been making relate very directly to the point that I think many of us would like to make. The thermal question becomes, I think, of both interest and concern, perhaps rightfully so, in that much of the input into the decision-making process is not of a technical nature but of a socio-economic political nature instead.

We have been very upset, I guess you could say, that this decision has been made in a manner that we would quarrel with. Rather we are faced with making a decision not in a manner we would call scientific but rather political. And we, as citizens, are not too keen about the prospects of making this decision on a political basis.

On the one hand, we have the power industry who for a few minutes present a series of scientific technical experts to sell their point. I think you recognize that these gentlemen are able to make such a complete presentation because they are in service to sell a product from which they get profits from which they can employ and hire technical and scientific experts to give the best possible presentation of their side. On the other hand, there are very few of us that make very much money from protecting the environment in our spare time. We get no profit from this and we do not have the opportunity to put in these profits to work and hire technical, scientific experts to present the best side of our argument.

Now what one must conclude from this is that it is necessary for the governmental agencies of all the States and the Environmental Protection Agency to do the functions that they are supposed to do as governmental agencies, and that is those things which individuals, citizen groups -- all citizens -- cannot do. We may not have the resources to present the best side or the best arguments for our side, and that is your job.

So many of us are led today to question what the Environmental Protection Agency and what the States have done in the last 2 years as far as finding the correct scientific evidence upon which to make a decision. We feel that making a decision only upon what the power companies can represent cannot be a decision based on adequate grounds. Objectivity, for scientists, is a goal, but it is never completely attainable, and what we would like to ask you today is why EPA has been reluctant to make these expenditures, why you were reluctant to approach the problem of doing the studies so that we do have the information upon which to make the decision.

One alternative would be for Commonwealth Edison to provide the same amount of money that they have used to make their studies to, let's say, BPI, so that BPI can make a study. BPI can't make that study if Commonwealth Edison isn't going to give them that money, and I'm sure that Mr. Comey would be glad to accept a check any time.

I think many of us would like to know why we have been discussing the thermal issue year after year, and your reports say that there is no technical information. And I think the most important point we have to make today is: When are we going to be able to come to an enforcement conference and see that you all have done your homework.

That is the conclusion of my statement.

MR. MAYO: Excuse me, Mr. Jontz. You said you had some material from Mrs. Troy that you wanted to submit --

MR. JONTZ: I do.

MR. MAYO: -- for the record.

MR. JONTZ: Yes. I have to retype one of them. I have another one of them, too. Mrs. Dale's letter is complete.

(The documents above referred to follow in their entirety.)

Statement of Sylvia Troy, President, Save the Dunes Council, before the Lake Michigan Enforcment Conference

September 21, 1972

I am Sylvia Troy, president of the Save the Dunes Council. The Indiana Dunes National Lakeshore was dedicated earlier this month after almost 60 years of herculean conservation effort. With thirteen miles of shoreline on Lake Michigan included in the park, we are vitally concerned with the health of the Lake. It would be ironic indeed if the Lake were not swimmable just when a sizable chunk of Indiana's shoreline is made available for public use.

The federal EPA has indicated that despite its efforts the quality of Lake Michigan at its southern end has not imporved. Dr. Stoermer's testimony before this Conference was alarming and expressed as scientific fact many changes we feared were occurring. Federal water pollution legilsation is moving in the direction of elimination of all discharge including thermal discharges, perhaps by 1980 -- but will that be too late for Lake Michigan?

If we have learned anything from the enforcement conferences (I believe I have attended them all), it is that the federal government must take the lead, and a consistent and positive one, in demanding a cessation of all pollutants into the Lake including heat.

In September of 1970 Department of Interior experts stated in their "white pages" that large amounts of heat are damaging to the lake. If they could not back up those assertions with hard evidence, why has not Interior or EPA pursued intensive research in this area?

Since 1970 EPA has done a shameful backsliding act on the thermal issue under pressure from the utilities. May we urge some statesmanlike courage on the part of EPA to maintain their no-heat standard of 1970.

I would also like to comment on the siting of power plants, which is perhaps not the direct focus of the Conference, but in our minds a closely related topic. The Indiana Dunes National Lakeshore is being surrounded by power plants; both fossil fuel and nuclear. Anywhere along the shore in Indiana one is confronted with utility smokestacks and soon, perhaps, cooling towers. EPA should be concerned with our total environment, including the problems of visual blight. We would hope that there would be a ban on construction of utility plants on Lake Michigan where they threaten in any way our natural and recreational areas.

Thank you very much for the opportunity to appear before this conference.

Lake Michigan Enforcement Conference
Sept. 19, 20, 21

I am unable to attend and express my concern about Lake Michigan, but I would like to state for the record that I consider it essential that you set *very* *strict* standards limiting thermal discharges into the lake to an absolute minimum.

I also hope you will take action to enforce deadlines, and stop all types of industrial and municipal pollution before the situation becomes even more serious.

Florence C. Dale
(Mrs. Arthur G. Dale)
300 E. Indiana Av.
Chesterton
Indiana 46304

MR. MILLER: I have a statement from Mr. Charles W. Kern of the Northern Indiana Public Service Company.

STATEMENT OF CHARLES W. KERN,
ENVIRONMENTAL TECHNOLOGIST,
NORTHERN INDIANA PUBLIC SERVICE COMPANY,
HAMMOND, INDIANA

MR. KERN: My name is Charles W. Kern. I am appearing today on behalf of Northern Indiana Public Service Company.

It is our pleasure to again appear before the members of the Lake Michigan Enforcement Conference so that the views of Northern Indiana Public Service Company may be known on the issues. Several of the areas currently under discussion at this conference affect public utilities in their responsibilities to provide electrical power and services to their customers. Northern Indiana Public Service Company serves approximately 320,000 customers in northern Indiana with electrical energy. All of NIPSCO's generation facilities utilize Lake Michigan waters for once-through cooling.

We recognize that a considerable effort has been under way for some time to assess the environmental impact of thermal discharges. A great deal of information has been collected from utility companies and a large amount of research has been sponsored by utilities to accurately assess the effect of thermal discharges. As this information has become available and has been evaluated, a clear picture of environmental effects from thermal discharges has become more evident. Detrimental effects resulting from thermal discharges to Lake Michigan have not been demonstrated.

Developments since the promulgation of the 3° thermal standard for existing plants on Lake Michigan indicate that a new approach to thermal regulation for Lake Michigan is necessary. The Lake Michigan Enforcement Conference in adopting the 3° standard did not gain the consensus of the member States. Only one of the four participating States accepted the standard and adopted it as law. It is apparent that there is a great divergence of opinion as to the thermal regulation appropriate for Lake Michigan even among the authorities responsible for the regulation.

The AEC draft Environmental Statement for NIPSCO's N-1 at Bailly Station submits an opinion that once-through cooling at that installation would be more acceptable than a closed system using a cooling tower.

At earlier hearings before this body, Northern Indiana Public Service Company has asserted that the evidence does not indicate a thermal regulation such as the 3° standard is necessary for Lake Michigan. We again urge the conference to reconsider the 3° limitation and to adopt some other mode of regulation that will be compatible with the realities of thermal effects, acceptable to the conferee States, and one which will not require the spending of millions of dollars without first determining, through factual evidence, that a given plant effluent is detrimental.

The data to date, upon which regulatory judgments must be formed, demonstrates that a study and evaluation of each thermal discharge and its surrounding environment is the only responsible manner in which thermal discharges may be adjudged.

Thank you.

MR. MAYO: Thank you, Mr. Kern.

Are there any comments, gentlemen?

MR. BRYSON: Yes, I have a comment.

In paragraph 3 of your statement, you say: "The Lake Michigan Enforcement Conference in adopting the 3° standard did not gain the consensus of the member States."

I think it is very important to point out that all 4 States did indeed adopt the 3° rise. There was a disagreement with respect to the mixing zone, but all four adopted that 3° rise.

MR. MAYO: Mr. Frangos.

MR. FRANGOS: Mr. Kern, did I understand the situation with this -- let me give you my understanding of what your statement says.

It is my understanding that your company had reached a decision to provide cooling devices at this facility?

MR. KERN: Yes, sir, that is correct.

MR. FRANGOS: And now your statement tells us that the AEC draft Environmental Statement at least suggested that is not the most acceptable environmental decision?

MR. KERN: That is correct also.

MR. FRANGOS: Thank you.

MR. MAYO: Any other comments, gentlemen?

Thank you very much, Mr. Kern.

MR. MILLER: Mr. Chairman, Mrs. Bieker's paper was passed out to the conferees, and then there was also a statement by Mrs. Ethyle R. Bloch, Chairman of the Coalition for the Environment, Fort Wayne, and her statement was passed out to the conferees yesterday, and I would like these two statements included as part of the record, and this would conclude Indiana's portion on the thermal question.

(The documents above referred to follow in their entirety.)

AMERICAN ASSOCIATION OF UNIVERSITY WOMEN
Indiana State Division

September 20, 1972

To The Lake Michigan Enforcement Conference
The Sherman House
Chicago, Illinois

From The Great Lakes Basin Task Force of the
Northeast Central Region of the
American Association of University Women

The Northeast Central Region of the American Association of University Women represents more than 31,000 university women of the states of Indiana, Illinois, Ohio, Michigan, and Wisconsin. Their Great Lakes Basin Task Force is empowered to state their position on the thermal standards to be imposed on Lake Michigan.

We are opposed to the addition of thermal pollution to the other pollutants that endanger the lake. We believe that for the protection of the lake and those who use its waters you should set high thermal standards. Any facility that is located or proposed to be placed on the shore or in the lake which would threaten to raise the temperature of the water should have to be proved not harmful, either of itself or as adding to the effects of other facilities. The burden of proof of its not being harmful should be on the user of the facility.

Helen K Bieker

Mrs. L. W. Bieker, Chairman, Indiana
Mrs. E. Horowitz, Illinois
Mrs. Joan Weikle, Ohio
Mrs. Jane Lahy, Michigan
Miss G. Freudenreich, Wisconsin

(Mrs. L.W.Bieker
1154 Ridge Rd
Munster, In 46321)

Coalition For The Environment, Inc.
Fort Wayne, Indiana

September 19, 1972

Mr. Perry Miller
Indiana Stream Pollution Control Board
Indianapolis, Indiana

Dear Mr. Miller:

The Fort Wayne Coalition For The Environment may seem too far away to make pertinent comment on Lake Michigan water quality, particularly since our area even lies in a separate watershed. However, we have several specific interests in Lake Michigan which we feel compelled to discuss. We would ask you to submit our comments to the Lake Michigan Enforcement Conference Chairman.

First, our electric power is not produced in our area but comes principally from installations sited on the shores of Lake Michigan. We have a decided interest in the thermal discharges and radioactive wastes from these installations for we are giving Lake Michigan the waste while we enjoy the product. The health of Lake Michigan involves our second parameter of interest which is the natural feature and recreational facility of the Indiana Dunes area and we rise to the defense of high water quality here, considering this an obligation of Indiana and U.S. citizens everywhere. We would add too that the policies and procedures promolgated by the Lake Michigan Conferees will have direct bearing on Lake Erie of which we are a direct tributary - so in this regard we feel a keen interest and concern with the Lake Michigan Conference.

We support continued controls on phosphate levels through detergent uses.

We support controls on pesticides and chlorides which have direct effect on the lake's biology.

We support all efforts to dissipate heat and minimize the thermal effects to the lake from the huge volume of water used in cooling processes for power production.

We support efforts to prove absolute safety of Emergency Core Cooling Systems in atomic generation before construction.

We support efforts to prevent any further siting of power generation or heavy industrial development on the Lake Michigan shore for pollution control reasons as well as aesthetic reasons (visual pollution).

We support flood plain management for tributaries and close surveillance for pollution sources including agricultural runoff.

We support all enforcement actions underway and believe these should be stepped up markedly with the next echelon of offenders tackled promptly and effectively.

Respectfully submitted,

Ethyle R. Bloch

Mrs. Ethyle R. Bloch, Chairman
COALITION FOR THE ENVIRONMENT
6340 Donna
Fort Wayne, Indiana 46819

MR. MAYO: To continue with the agenda, the State of Michigan and the related speakers are next.

MR. PURDY: Mr. Chairman, I would like to initiate our report by having Mr. Fetterolf give a report on the "Effects of Chlorinated Powerplant Cooling Waters."

STATEMENT OF CARLOS FETTEROLF,
CHIEF ENVIRONMENTAL SCIENTIST,
MICHIGAN WATER RESOURCES COMMISSION,
LANSING, MICHIGAN

MR. FETTEROLF: Mr. Chairman, conferees, ladies and gentlemen.

The common practice at the utilities and industries using water as a coolant is to introduce chlorine intermittently into condenser tubes as an antifoulant. Field investigations by biologists on the staff of the Michigan Bureau of Water Management in the fall and winter of 1971 --

MR. PURDY: Carlos, do you have copies of that to pass out -- that report that you are reading now?

MR. FETTEROLF: I don't think so.

MR. PURDY: If you don't know, I don't!

MR. FETTEROLF: That is what the staff did.

Field investigations by biologists on the staff

C. Fetterolf

of the Michigan Bureau of Water Management in the fall and winter of 1971 indicated that chlorinated compounds discharged in powerplant condenser cooling waters could be toxic to fish life. An Environmental Protection Agency grant was obtained to study in greater depth the effects of these intermittently discharged chlorinated compounds to fish life.

The objectives of our proposal were to determine chlorine toxicity to various fish species, document any seasonal variations in toxicity and note any fish avoidance behavior. A further objective was to establish statewide water quality standards for chlorine discharges.

To date, work has been conducted at the Campbell and Cobb plants in the Lake Michigan Basin, Karn and Weadock plants in the Saginaw Bay Basin, Connors Creek plant in the Detroit River Basin, and the Monroe plant in the Lake Erie Basin. These plants were selected to include different intake and receiving chemical water qualities, a variety of fish life and variety of physical receiving waters. Caged fish studies will be conducted at each plant 4 times during the coming year. In these studies, various fish species held in cages in the condenser cooling water channel and receiving water are exposed to the cooling water discharge containing chlorinated compounds. Throughout each exposure period, the chlorine concentrations are measured with an amperometric titrator.

Preliminary results indicate that during the summer months temperature of the discharge is the most critical factor affecting survival of salmonid species. Fish species that are resident in the discharges at this time -- white bass, gizzard shad, sheepshead, catfish, gar, pike, carp -- are able to survive the increased temperatures and the low level chlorine concentrations.

To date, caged fish results using brown trout, when discharge temperatures were suitable for their survival, were obtained at Campbell plant on Lake Michigan. Significant brown trout mortality was observed throughout the mile-long channel during chlorination. There was a slight decrease in mortality at the farthest downstream station. No mortality of brown trout was seen at either control station. Similar results were obtained with the fathead minnows. No stations could be placed in Lake Michigan due to high waves. Subsequent monitoring showed that the chlorine plume extended into the lake approximately 600 to 800 yards.

Skindivers made observations of fish behavior in the Campbell plant's discharge channel throughout one chlorination period. Resident fish -- mainly alewives -- in the channel became very excited when the peak chlorine concentration was reached, but returned to normal immediately after passage of the chlorine slug. Similar behavior by rainbow trout and white suckers was observed by divers during chlorination at the Big Rock plant on Lake Michigan.

In summary, preliminary results of this work indicate that concentrations of chlorine toxic to salmonid fish do occur in powerplant discharge channels. The present policy of restricting intermittent discharge of chlorine to levels less than 0.5 mg/l for no more than 30 minutes in any 2-hour period may have to be modified. Our preliminary results show acute toxicity to brown trout exposed intermittently to as little as 0.07 mg/l of total chlorine for a 96-hour period.

Our work with fish more tolerant to temperature and chlorine (fathead minnows and sunfish) has been inconclusive but indicates less of a problem than for the salmonid fish.

During summer months, temperature in these channels prohibits fish that are more sensitive to chlorine from inhabiting the area.

We will continue this project during the coming fall and winter months when salmonids can and do inhabit the channels and plumes. We will then be in a much better position to recommend limits on levels and duration of chlorine discharged by Michigan powerplants. It appears that each plant will have to be evaluated and limits applied on a seasonal or monthly basis. The actual limits recommended at a given plant will reflect the intake and receiving water qualities, fish species and life stages present, the peculiarities of the particular cooling water discharge system, and the physical characteristics of the receiving water body.

That concludes my statement, Mr. Chairman.

MR. MAYO: Any questions or comments, gentlemen?

MR. BRYSON: As a way of comment, I would like to point out that on page 115 of the "Summary of Recent Technical Information Concerning Thermal Discharges into Lake Michigan" by the Argonne National Laboratory, there is a comment on the chlorine levels that Dr. William Brungs has found applicable to water quality criteria in Lake Michigan.

Dr. Brungs is on the staff of the National Water Quality Laboratory at Duluth, and these values do provide guidance for acceptable levels of chlorine in the receiving waters of Lake Michigan.

MR. FETTEROLF: And by way of comment, I have worked with Dr. Brungs when a panel named by the National Academy of Sciences was trying to decide on the water quality criteria for chlorine in intermittent dosages after short time periods, and after Dr. Brungs had reviewed a great deal of information -- about all there was available -- and had reached his decision, recent information provided by the Michigan Water Resources Commission staff caused him to alter his recommendation in a downward, more conservative way.

MR. BRYSON: Do you have those figures available on how he did revise that?

MR. FETTEROLF: That information is not public information yet to me. I believe his final recommendation to you included some of our information.

When did he give his final information to you?

MR. BRYSON: This is dated December 20, 1971.

MR. FETTEROLF: It has been changed since then.

MR. BRYSON: Okay. We will communicate with Dr. Brungs and get the latest information and transmit it to the conferees.

Carlos, Mr. Zar just pointed out, in the Argonne report, the National Water Quality Laboratory recommendations were reissued about June 1972. There were no changes in the specific recommendations.

MR. FETTEROLF: Well --

MR. BRYSON: Either way I will check with Dr. Brungs and transmit the required information to the conferees.

MR. MAYO: Any other questions or comments, gentlemen?

Thank you, Mr. Fetterolf.

STATEMENT OF RALPH W. PURDY,
EXECUTIVE SECRETARY,
MICHIGAN WATER RESOURCES COMMISSION,
LANSING, MICHIGAN

MR. PURDY: In the request for State participation in this conference, your letter, Mr. Mayo, directed that we report on the rationale and difference between the recommendations issued by the Administrator, following the prior session of this conference, and the water quality standards as they relate to thermal discharges that were adopted by Michigan.

In the report that I presented on Tuesday and asked to be incorporated into the record, a comparison was made of the thermal standards, as adopted by Michigan, with those recommended by the Administrator. (See pp. 138a, 138b and 138c)

I would like to summarize that briefly, at this point in time, and add some additional comments.

With respect to the mixing zones, the Michigan Water Resources Commission did not adopt the recommendation of the Administrator as it related to a maximum distance of 1,000 feet from a fixed point adjacent to the discharge. The mixing zone criteria that Michigan adopted is as follows:

The mixing zones for thermal discharges will be established on a case-by-case basis and will be designed to minimize effects on the aquatic biota in the receiving waters and to permit fish migration at all times. Configuration will be based on the physical characteristics of the receiving water body and the biological importance of the area to be protected, such as spawning areas, migratory routes, etc. Within mixing zones, other standards than those presented may be applicable but will not interfere with the designated water uses for the area.

The Michigan Water Resources Commission, at the time that it adopted this criteria, felt that on the basis of the information that had been presented to them at the public hearing, that such a criterion represented a reasonable approach to the thermal discharge matter. In fact, it appears to be quite similar to the recently announced position of EPA as it relates to thermal discharges and as that policy is shown in the report that EPA has presented to this conference.

The Commission, in adopting this on a case-by-case basis fully recognized that you could not treat each individual discharger as a case by itself without some consideration being given to the effects of a number of cases on that particular body of water. And, in fact, later on in the standard adopted by the Commission, they addressed themselves to that problem in the same fashion that the Administrator's recommendations had the nonproliferation statement.

For the southern portion of Lake Michigan, the standards adopted by Michigan in the way of a monthly maximum temperature are identical to those recommended by the Administrator.

For the northern portion of Lake Michigan, the information that we have available to us, and that was presented to the Commission, indicated that this particular portion of the lake could be maintained and should be maintained at a lower temperature than the southern portion of the basin and the standards adopted for that sector of the lake are somewhat lower than those -- that is a lower temperature as a monthly maximum was adopted by Michigan.

The criteria with respect to water intakes, although worded somewhat differently, I think contains the essential requirements of the Administrator's recommendations.

The same pertains to the geographic area affected by the thermal discharge.

With respect to backfitting of existing plant discharges, the Water Resources Commission did not accept the recommendation to require backfitting, but determined that on a case-by-case basis that the need for such backfitting would be determined in view of studies that were being required of the discharger, and further by studies conducted by the Michigan Water Resources Commission, and any other such information that would be available to them by studies conducted by others.

With respect to the moratorium or so-called nonproliferation of new plants on Lake Michigan, this was agreed to and incorporated in the Michigan Water Resources Commission requirements as a moratorium for a 5-year period at which time a reevaluation will be undertaken to see whether or not that policy should be modified in view of the information then available. In no way does this indicate, at this point in time, that the Water Resources Commission does not intend to continue that restriction. It indicates only that, at that time, the Commission will establish this as a point certain, that the thermal temperature standards would be reevaluated and, in fact, all standards, other than thermal standards, will be reevaluated on a routine basis.

In the comments as to the Commission not adopting a reporting requirement in its standards, a reporting requirement is included in the Michigan statute and, as such, it is not repeated in a standard. In fact, if the Commission had attempted to adopt this as a part of an administrative regulation, it would have been stricken from that regulation by our Legislative Service Bureau in its review of those regulations.

Pre- and post-operating studies are included by an order of the Water Resources Commission. Those studies -- that is pre- and post-studies by the discharger -- those studies are under way; information has been developed; and periodic reports have been filed with the Commission.

That completes the State report at this time.

MR. MAYO: Any comments or questions, gentlemen?

MR. McDONALD: Mr. Purdy, in regard to the mixing zone question, in actual fact, in relation to the Donald C. Cook plant and the Palisades plant, have you applied your mixing zone criteria to establish the zone of mix for those two plants?

MR. PURDY: Modeling studies were conducted by both proposed dischargers and, on the basis of those modeling studies, a mixing zone of the size identified by those modeling studies has been established.

The Commission reviewed the modeling studies and, on the basis of information that was available, at that point in time, did not feel that it was necessary to restrict the size of that mixing zone to an area less than that shown by the modeling studies.

MR. McDONALD: What does that mean, that there is no definable mixing zone there; you have not restricted them?

MR. PURDY: No, sir, that does not mean that. In both cases, a mixing zone defined as -- I can't remember whether it is acres or square miles -- has been identified.

MR. McDONALD: Well, relating it to the 1,000 feet that was recommended by the conference, what type of footage are we talking about?

MR. PURDY: In both cases, it would be considerably larger by several orders.

MR. McDONALD: Do you have those figures?

MR. PURDY: I do not have those available. I can furnish them to the conferees.

MR. McDONALD: I think that would be helpful.

MR. PURDY: I should add that the Commission, in its studies, has engaged the services of Willow Run

Laboratories to do remote sensing on thermal plumes to the Great Lakes so that it will have this information available to them to add to its ground studies that its staff is conducting.

MR. McDONALD: How will you enforce a violation of mixing zones if one of these plants violates your mixing zone area?

MR. PURDY: I think two considerations will be necessary: One, in fact, has an injury occurred due to the fact that the mixing zone was larger than that indicated by the modeling studies? The size of the plume will have to be determined by surveys and, in this case, the most expeditious means of determining the size of that plume will be by aerial remote sensing techniques. However, this will not satisfy the requirement for a determination of the effect of the plume during the winter operations and, as such, that plume will have to be studied from boats and with depth thermometers if, in fact, we can do this during the winter months on the lake.

MR. McDONALD: Does this really mean, in effect, then, that the mixing zone -- the real extent of the mixing zone will not be established until the plants are fully operable, and until there is sufficient year-round evidence of the type of discharge that they have in terms of plumes?

MR. PURDY: The final proof will not be in until those plans are in operation and you can, in fact, observe.

MR. McDONALD: How long will that be?

MR. PURDY: If I knew how long the licensing procedure was going to take I might have a better means of predicting that. (Laughter)

MR. McDONALD: Let me phrase the question another way: How long will that be once the license is granted, assuming that it is granted, along the lines of your mixing zone? How long before you know what the extent of the real plume is and what the extent of the damage may be so that you can enforce anything beyond that zone?

MR. PURDY: The thermal plumes for the Palisades plant at a 60 percent power level are being observed at the present time. So that at least at the 60 percent level that information is being accumulated now, and the plant only reached the 60 percent power level this year. So that it will be accumulated — that information will be accumulated as soon as the plant goes into operation.

With respect to the Cook plant, the Water Resources Commission, in its order, as it relates to that plant, set an outside limit of 2 years when it would evaluate the effects of that discharge, as shown by the study.

However, again, periodic reports are being filed, and the Commission, when it set the 2-year date as an outside limit, made it clear that, at any time the periodic reports showed that there was a significant increase to Lake Michigan, it anticipated taking immediate action requiring remedial facilities.

MR. McDONALD: Well, let me ask, again, now: How long will it be after the plant is fully operable that you will impose a mixing zone with some precision so that a discharger and others know what that zone is? You say a 2-year period of evaluation. Is that the time it is 100 percent operable?

MR. PURDY: That is an outside date. If, at any point in time the studies show an injury and that there is a need to take remedial action, it will be taken then.

MR. McDONALD: Now, an injury to what? Where? Outside the mixing zone? Inside?

MR. PURDY: If the injuries that take place within the mixing zone are such that they impair the total ecology of Lake Michigan, it will be taken on the basis of the effect within the mixing zone.

MR. McDONALD: What do you mean by "total ecology of Lake Michigan?"

MR. PURDY: This morning we heard reports from Mr. Barber on the number of fish fry, eggs, adult fish, that could be killed either by impingement on the water intake screen, by thermal shock after traveling through the condensers, or by chlorination -- all of those things must be considered. And if a determination is made that those will have a significant effect upon the fishery of Lake Michigan I fully expect the Water Resources Commission to take action.

MR. McDONALD: Now, where is that information going to come from in toto -- the total impact upon the lake?

MR. PURDY: That information is going to come from Water Resources Commission staff employees. Hopefully we will have the benefit of the experience of others, including Mr. Barber and his colleagues, in evaluating that data.

MR. McDONALD: Well, I know of no overall program at the present time that is on the horizon, that is funded, that has been agreed upon to assess this total impact upon the lake, that you would relate these discharges to.

Maybe I am wrong on that, but I don't know. Do you, Mr. Mayo?

MR. MAYO: No, I am not aware of any.

MR. McDONALD: I am not saying we shouldn't have one, but if you are going to assess this discharge and the severity of it to the total impact of the lake, it seems like we need a program for the total lake, that we certainly don't have if that is your criteria for assessment.

MR. PURDY: It seems to me this is what we are interested in.

MR. McDONALD: I am pursuing this point for this reason, Mr. Purdy — and I was not a part of the deliberations at the last conference. But I do know, on the basis of the record, that the mixing zone that was decided upon — 1,000 feet fixed point — was given a good deal of thought, and it was based upon minimizing damage to aquatic life and for ease of enforceability. And, as you know, if you have got a regulation and you can't enforce it because of the difficulty of enforcing, and the lack of evidence to enforce it, it is a very difficult regulation when it comes to meaning something.

So your regulation, if the prime emphasis on enforcing it is going to be the total lake program -- unless I am missing the point here — it is going to be extremely difficult to enforce because we don't have a total lake program.

MR. PURDY: Well, I feel very uncomfortable in recommending to my Commission that it adopt, or that it adopt a particular requirement for the sake of ease of enforceability.

Occasionally the requirements of the Commission are challenged in the courts, and unfortunately the Commission does not sit on the witness stand; its staff sits on the witness stand. And when I am on the witness stand I would like a rationale better than "ease of enforceability" as to why a particular requirement was, in fact, adopted.

MR. McDONALD: Well, I think, when I explained "ease of enforceability," I was talking beyond enforceability. I said that you conferees at the last session based this mixing zone on damage to aquatic life, and attempting to minimize that damage by establishing the 1,000 feet; at the same time having a fixed footage that would be recognized throughout the lake as a uniform parameter and thereby having a precise zone for enforcement and outside that zone would constitute a violation.

MR. PURDY: As I recall that last session of the conference, we conferees were faced with a Federal recommendation that we received the night before the session, and that at the close of the session we did, in fact, agree to present those, if the Administrator concurred in them, to our respective States for their adoption under State and local law.

I do not remember any great amount of deliberation, either privately or in the record, that would support the particular rationale of 1,000 feet.

MR. McDONALD: Well, I won't debate that, although I have been advised that there has been considerable thought given to the 1,000 feet.

A thousand feet does sound very precise. I think maybe I would agree with you if it was 998 feet, you would think a great deal of thought went into that. (Laughter)

Let me move on to one other point, Mr. Purdy.

In terms of Recommendation III of the conference -- that is Roman III -- relating to corrective action for water intakes to minimize entrainment and killing of fish on intakes -- have there been reports of such entrainment, such fish mortalities in fisheries at Consumers Power Company's Campbell plant?

MR. PURDY: Well, many of the references cited by -- not many, but some of the references cited by Mr. Barber, and some of the references cited in other information that has been presented to this conference, have been gathered by the members of the Water Resources Commission staff in its studies.

The full report shows that the Michigan Water Resources Commission has initiated a program to determine the significance of intake mortalities to fish and other aquatic life. Present studies under way at two existing facilities will also give a better indication whether intake structures are detrimental to aquatic organisms which pass through them.

Sometime ago, Michigan asked your office if it had information that would help them guide their studies and to evaluate the adequacy of present intake structures as it relates to minimizing the entrainment of organisms drawn into those structures.

If you have such information available to you, to aid us in our studies, we would appreciate that information.

MR. McDONALD: We will look into this and pursue it again, if we do.

Are you saying, then, that at the present time that Michigan does not have a program to reduce the entrainment damage to desirable aquatic organisms?

MR. PURDY: We have studies under way to determine whether or not this is a problem at the various intakes, and hopefully this will give us some guidance as to the type of intake structure that is necessary to minimize the entrainment. But we do not have a corrective program under way at the present time because I do not have the criteria from which an evaluation can be made.

MR. McDONALD: Well, is the company independently doing anything -- the individual companies -- because Mr.

Barber's report talks in terms of deaths of hundreds of thousands of fish.

MR. PURDY: Well, Mr. Barber's report also talks about the independent studies that were being conducted by several of the companies and, again, those studies have been developed as a part of a cooperative effort between those water users, our Fisheries Division of the Michigan Department of Natural Resources and, in turn, some Federal representatives, to advise that discharger or that water user on the type of studies that it should be making to determine whether this is a problem, and the remedial action necessary if a problem is found.

MR. McDONALD: Are the power companies themselves exercising any initiative in trying to solve what appears certainly to be an apparent problem?

MR. PURDY: They are the ones making those studies.

MR. McDONALD: Are you hopeful for some solution in the fairly immediate future?

MR. PURDY: It will depend upon the information that those studies develop and how complicated the remedial action might be.

MR. McDONALD: One final area, Mr. Purdy: Michigan, as I understand your standards, has declared a moratorium on the construction or approval for construction of new powerplants until 1975?

MR. PURDY: This is new powerplants that include a once-through cooling system with discharge into the Great Lakes.

MR. McDONALD: Now, what will happen in 1975 and why was that date set?

MR. PURDY: As a date certain by which this will be evaluated by the Commission on the basis of studies and information available to them at that time. I can't predict what will happen. However, I would assume that if the information that is developed confirms the fears and the projections of damage that have been presented to this conference and to prior conferences that that prohibition against the use of the once-through cooling system will be continued, and, in fact, it may even be made more restrictive in view of the technology that might be available at that time to provide cooling systems that would fill the need of that particular thermal discharger.

MR. McDONALD: Thank you, Mr. Purdy. I think your answers have been complete on a very difficult and complex subject.

I am still bothered about this question of enforceability of mixing zones, very much so.

MR. MAYO: Mr. Purdy, I have a question, if I may.

I think it may be helpful to the conferees to have a little better insight into what the review process has been in Michigan with respect to the models of the discharge facilities.

Did the State apply to a given model a variety of discharge configurations, or did the State review a specific configuration proposal by the discharger and not get involved in a comparative evaluation of alternative discharge configurations?

MR. PURDY: Well, the modeling studies were performed by the thermal discharger. The extent of those modeling studies depended upon the particular situation, as it related to the Palisades plant.

When those modeling studies were conducted, the outlet structure was, in fact, in place, and therefore the study was made on that particular outlet structure.

Further, at that point in time, a decision had been reached to modify that once-through cooling system to a forced draft wet cooling system, so that the once-through cooling system won't apply, on an interim basis, I believe, until 1974.

The modeling studies for the Cook plant were conducted prior to the construction of that outlet facility and, in fact, a number of configurations were studied, and the size of plume that each configuration would have was reviewed with members of my staff. A decision was reached as to which would be likely to have the least impairment upon Lake Michign water quality, and then that particular configuration was selected for more detailed studies.

MR. MAYO: Just by way of observation, Ralph, each one of us who shares the responsibility of trying to reach some balance between what is a reasonable burden for the discharger to assume and what is a reasonable burden for the regulatory agency to assume are always challenged by what is a "reasonable" balance.

It seems to me that in this instance the State of Michigan has certainly taken on a rather onerous burden of proof when it comes to making a determination of the extent to which it will judge any damage being done under those circumstances as the basis for taking some form of corrective action. I think it is an onerous burden indeed.

MR. PURDY: Your comment there, Mr. Mayo, reminds me of some earlier statements that have been presented to this conference. Number one, that the burden of proof ought to be upon the waste discharger and should not be a cost borne by the State.

On the other hand, there are frequent statements that it is ridiculous for a State regulatory agency or a Federal regulatory agency to depend upon information furnished to it by the waste discharger, and therefore why don't you do something?

In this case, we are making confirming studies but, in turn, the Commission orders require considerable pre- and post-operative data, not only on the effluent but the effect of that effluent upon the receiving body of water to be performed by the waste discharger. So we hope that we are sharing that burden before one of the waste dischargers points it out.

They are also sharing in the burden of the State cost of performing that surveillance activity beyond what they would pay and what has been, say, normal taxes -- and I don't intend to call this a tax because our legislature did not call it a tax -- but in Michigan an industrial waste surveillance fee is imposed. That fee is based upon the volume and so-called strength of that discharge. The purpose of that fee is to finance monitoring and surveillance activities by the State -- finance in part -- those activities that are made necessary by the fact that that particular waste discharger is discharging something to waters of the State and it is necessary, then, for the State to carry out a monitoring and surveillance program.

MR. BRYSON: I have one quick question: The studies that you and Mr. McDonald were going back and forth on -- were they on fish mortalities in environmental impacts, or are they studies on modification of the intake structures at Campbell and Palisades?

MR. PURDY: The first part was the mortalities that are caused by impingement on the screens, and so forth.

The second part was what sort of remedial action can be taken to prevent that from taking place, whether it be bubble curtains, change in the velocities or whatever myriad of actions might be available to us.

MR. BRYSON: Okay. What is the timing on the terminal points on the studies, or is there a terminal point at this stage of the game?

MR. PURDY: No terminal point at this stage in the game. We don't know when we will have all of our answers.

MR. McDONALD: Mr. Purdy, if, when all of the returns are in, and you have a mixing zone, and if you are able to assess total impact upon the lake in the studies that are not yet designed -- I don't know if they are on the horizon -- but if all these things come to be, would you require, if substantial damage was demonstrated, a company to backfit?

MR. PURDY: The Water Resources Commission has, for example, notified the Indiana-Michigan Electric Company that if such studies do, in fact, show that, that it will be required to backfit, and it has requested and has received from that company plans by which it would progress toward that backfitting; the plans are on the shelf ready to be used, so that there will not be a delay for preparation of plans. A contingency plan is on the shelf.

MR. McDONALD: Again, in closing, I think the thing that really is troublesome here is finding when you would trigger the action to put those plants into place. I frankly do not see the triggering mechanism that you may think is there.

MR. PURDY: I am confident that if we don't find it that you will help us find it! (Laughter and applause)

MR. McDONALD: I didn't realize you brought that big a contingent down from Michigan.

MR. PURDY: I think that was your family. (Laughter)

MR. McDONALD: I am sorry. I missed that.

Well, that is a good happy note to end on.

MR. PURDY: I would also point out that if the mixing zone does, in fact, happen to be larger than that established by the order, that under Michigan statute this would require them coming back to the Commission, and we will have another crack at whether or not it should be enlarged.

I would like to call upon Alma Voita, at this point in time.

STATEMENT OF ALMA T. VOITA,
BRIDGMAN, MICHIGAN

MRS. VOITA: Alma Voita from Bridgman, Michigan. I am just an angry housewife. And when you add to that, that I am a grandmother, you will know just how angry I am, because I am only concerned about my grandchildren and all of the children of that generation. And I want to say to you men sitting at this table: I hope each one of you realizes just what you are going to have to account for if anything worse happens to this lake than has already happened.

And I just can't see how, when you listened to the report -- was it of Dr. Stoermer -- and realized that the algae in this lake is already beyond the danger level, how in this world can the addition of heat to any part of the water of Lake Michigan help?

Now, it seems to me that we are here to save the lake, to keep it from getting worse. Now why aren't we willing to take the steps that are going to do that?

Just as Mr. Purdy was talking, I was thinking that if -- supposing the Donald C. Cook plant was in operation and it was discovered that all this harm was being done. Do you know how long it would take them to correct that matter? And do you know all of the additional destruction that would go on in the lake in this southern end of the lake that is completely -- it is completely impossible to reverse the effects that take place here. We have heard this for years.

I have attended almost all of the conferences that have been held and I have listened time after time to this type of evidence. It seems to me it is about time that we are taking cognizance of this fact.

Now, I wrote a statement, and you can all sit back because there is nothing technical in it. You don't have to think of a thing except just maybe a little bit of something to your conscience.

Now, besides this heat going on in the summer months, there is also the fact that the heat would be going on in the winter months.

We, who -- I will start out this way though, telling you that we have had a summer home on Lake Michigan just a mile south of the Donald Cook plant for 22 years, and just this last summer we remodeled so that we are going to have that for our permanent home.

Now, we realize -- all of us who live within a radius of maybe 5 miles from the plant -- how much that ice cap on the water during the winter months means to all of us in the way of erosion to the beach. Now all of these billions of gallons of hot water going into the lake hour after hour, day after day, year after year, and in the winter months, it would completely alter this condition that is so beneficial to us.

I had this sort of organized and it is a little bit difficult.

We who live on the lake have riparian rights. Now my understanding of our riparian rights is that each owner of property with this right has the right to have a peaceful and safe enjoyment of his home. And I think that this is guaranteed by the United States Constitution.

Overuse and misuse of a body of water can cause damage to property values and is a violation of the law of riparian rights.

Now it seems to me that the preservation of the environment should be the primary concern of the governing bodies of our land. The waters of Lake Michigan are Federal waters and the lake belongs to the people to use and enjoy, and it is their right not to have it jeopardized at any time. We have the right to expect our government to protect our rights and interests at all times.

Now, I was present at the hearing in regard to the Palisades plant, and it seemed to me at that time that it was absolutely unfair to think that a group of citizens and environmental groups had to go to the expense and all of the effort to take the matter to court, to the law, to employ lawyers, to bring about what it seems to me our governmental bodies should do for us; i.e., take care of our rights. And finally it was done in this manner, and the Palisades plant is required to put up cooling towers. But in the meantime they are using the lake for once-through cooling until they get this done, which I don't know when it will be.

I want you to know that we -- and I am speaking for people all along the shore -- are not opposed to the use of nuclear power for the purpose of generating much needed electricity. We are willing to live in the shadow of a big powerplant, like the Donald C. Cook nuclear plant, the largest being constructed on Lake Michigan, realizing fully the hazards that it entails.

But we are opposed to once-through cooling involving the introduction of quantities of heated water into the lake. We are opposed to any radioactive discharges into the lake involving potential hazards which can never be retrieved. We are opposed to any tampering of the lake which already is in a condition of eutrophication beyond redemption. And, finally, we are opposed to the apparent permissive policy of our governing bodies.

Now I realize that you men have put in a great deal of time and effort into this problem. I know that it has been a year and a half since the first enforcement conference, and I realize that you have been thinking about this and working on it ever since.

Isn't it time that a definite standard be made that will really assure us that nothing worse than has already happened will happen to our lake?

Thank you.

MR. PURDY: Mrs. Voita. Correct me if this is not your understanding, but, for the purposes of correction or correctness of the record as far as the conferees are concerned, is it not true that the citizen intervention in the Palisades matter was at the AEC licensing hearing level, and that this matter was resolved by agreement between the intervenors and the Consumers Power Company at that level, and that the cooling towers were not established as a requirement of a court decision?

MRS. VOITA: I believe that is so.

I felt very sorry to realize that Indiana feels that they would not have had to have done this, because I think they are doing absolutely the right thing, and it just seems to me that they should be commended for having done it in spite of the fact that they might not have had to, and I believe that is true. I believe what you say is absolutely true.

MR. PURDY: It was not a decision that was found to be necessary by the court. It did not reach that stage. It was an agreement between --

MRS. VOITA: Well, it seemed to me that Palisades could not come through with any evidence that proved that they were not going to harm the lake. Therefore, they agreed.

MR. PURDY: I would like to call on Mr. O. K. Petersen of Consumers Power Company.

STATEMENT OF O. K. PETERSEN, ATTORNEY,
CONSUMERS POWER COMPANY,
JACKSON, MICHIGAN

O. Petersen

MR. PETERSEN: My name is O. K. Petersen. I am an attorney for Consumers Power Company.

We have passed out a copy of what we propose to say today. We will not say all of that in order to conserve time and perhaps be one of the first to do so.

MR. MAYO: Do you want this printed statement introduced as if read?

MR. PETERSEN: Virtually yes. I will make some small changes in the statement as I go. I will be reciting much of the first, second and seventh pages.

(Mr. Petersen's printed statement follows in its entirety.)

CONSUMERS POWER COMPANY
STATEMENT TO
THE LAKE MICHIGAN ENFORCEMENT CONFERENCE
Chicago, Illinois
September 19-21, 1972

The Report of the Environmental Protection Agency to the Lake Michigan Enforcement Conference on (the) Thermal Question, September, 1972[1] provides a brief section as background on the history and workings of the Conference. While it would not be appropriate to give a critique on the entire history, the remarks concerning the last session, which occurred on March 23-25, 1971, do require comment.

It is stated that the report of the Technical Committee[2] authorized at the October 29, 1970 Executive Session was presented at the March 23-25, 1971 session and then "on the basis of the full discussion on the question, the conferees made certain findings and recommendations" which were subsequently approved by the EPA Administrator.

In fact, at the March 23-25 Conference the Federal Conferee presented a new position, prior to any discussion and quite unrelated to the Technical Committee Report. That position was pushed through the conference before it could be carefully evaluated, with the Federal Conferee explaining that the EPA position was that it was anxious to have the states employ the EPA "recommendations" and would "employ the full extent of the administrative and the legislatively defined processes that are available to the Environmental Protection Agency to achieve that end."[3] The arbitrary circumstances under which the findings and recommendations at the last conference were promulgated should cause no one to wonder that the states have in large measure rejected them.

We would also take issue with the inference on Page 11 and in Tables I - IV that the latest recommendations of the Enforcement Conference are "established requirements." The recommendations of the Conference are only that and require the regulatory authority of the states for implementation. In this regard, it is our position that the procedure for enforcing Enforcement Conference Recommendations, contained in the Refuse Act regulations, is invalid.

There are some items of technical information upon which we would like to comment as the result of a review by Consumers Power Company's technical experts. Some involve relatively minor corrections or elaborations on the "Argonne Report"[4] and the others are to advise you of additional information that might be considered in this review.

Beginning on Page 8 and again on Page 36 of the Argonne Report, mention is made of a study and report by the University of Michigan Willow Run Laboratories involving numerous multispectral aerial scanning observations along the eastern shore of Lake Michigan during the spring thermal bar development period in 1971. The power plants covered included the J. H. Campbell Plant, the Michigan City Plant and the Bailly Plant. The project involved 17 separate flight lines and a total of 80 sets of data for all of the lines, the processing of which "showed no evidence of any water masses that could be attributed to the effect of warm water discharges from power plants into the lake."[5]

We believe the importance of this work warrants its inclusion into the record of this conference. The original copies include a large number of color photographs which would aid the reader in interpretation, however, the black and white copies provided show or describe the major features of interest. Color copies can be provided on loan should any of the conferees desire. It should also be noted that in connection with the Willow Run aerial flights numerous water samples were collected by field personnel for correlative study. Detailed phytoplankton data and other water quality observations are included in the Benton Harbor Power Plant Limnological Studies Part X, Cook Plant Preoperational Studies 1971, Special Report No. 44, Great Lakes Research Division, The University of Michigan, August 1972.[6]

On Page 28 of the Argonne Report there is mention of a tabulation of one month's growth of periphyton in the Palisades area during May - August 1969 which appears in the supplement to the Environmental Report for the plant.[7] Actually, the quantitative data referred to, include nine separate samples at various periods; May-June, May-July and July-August. The same supplement also includes data on periphyton growth at three locations near Palisades in May-June, 1968 based on chlorophyll analyses. Additional quantitative periphyton data collected near the Palisades Plant in 1970 and in 1971, before this phase of the program was discontinued, are included in a Consumers Power Company report to the AEC, entitled "Environmental Impact of Plant Operation up to July 1, 1972," dated July 19, 1972.[8] The technique of using artificial substrate for monitoring attached periphyton growth in the vicinity of the Palisades Plant was abandoned in favor of doing detailed analyses of substrate samples collected along the beach. Data are not yet available on these collections. The above referenced 1972 report includes recent information on all aspects of the thermal effects study program at the Palisades Plant and should be consulted for extensions of data referred to in the Argonne Report.

The Argonne Report, as well as the Report of the Environmental Protection Agency to The Lake Michigan Enforcement Conference on the Thermal Question, includes the B. C. Cobb Plant in Muskegon, Michigan as contributing to the thermal loading of Lake Michigan. This plant is located on the east end of Muskegon Lake, about five miles from the shore of Lake Michigan, and it is inconceivable, either from a theoretical analysis or from the numerous field measurements that have been made, that the plant could in any way contribute preceptably to the "thermal question" of Lake Michigan. It should be excluded from any further consideration in this context.

On Page 34 of the Argonne Report reference is made to 1970 and 1971 Water Quality Studies conducted by Consumers Power Company and the thermal plume measurements contained therein.[9-10] In connection with the reported surveys, various biological collections were made and analyzed as described in the following reports by Beak Consultants, Inc.

a) 1970 Biological Survey of Lake Michigan Near Holland, Michigan, November 1970. (Includes identification of benthic organisms from three replicate collections from each of 13 stations sampled offshore of the J. H. Campbell Plant discharge in August 1970).[11]

b) 1971 Biological Survey of Lake Michigan Near Holland, Michigan, April, 1970 (Includes identification of benthic organisms from three replicate collections from each of 13 stations sampled offshore of the J. H. Campbell Plant discharge and one artificial substrate sampler in the plant intake in August, 1971. Data are also included on fish caught by seining in the vicinity of the intake and discharge).[12]

c) Identification of Miscellaneous Fish and Artificial Substrate Samples, 1971, April 1972 (Includes, for stations on Lake Michigan, identification of organisms recovered from artificial substrate samplers placed in the discharge of the Big Rock Point Plant).[13]

It should be noted that additional surveys are being undertaken this year to provide further data on aquatic characteristics in the vicinities of these plants.

On Page 49 of the Argonne Report, a study conducted by the Michigan Water Resources Commission in the vicinity of the J. H. Campbell Plant is cited.[14] There are two statements included in the citation which may be misleading if considered out of context with the entire report. In the second paragraph it is stated that "Large amounts of filamentous green algae, Cladophora, were collected in the trawl through the plume area. The origin of the algae was unknown." We believe it should also be noted that another somewhat parallel trawl, also in the plume but in shallower water did not encounter large amounts of filamentous algae, and that surface water samples showed relatively fewer numbers of green algae in the vicinity of the plant than at the control stations.

In the same report it was stated that increased benthic productivity in the plant's outfall was the only adverse effect that could be attributed to the warm-water discharge. We would note that the interpretation of adversity is tenuous at best in view of the fact that there were no significant increases in total numbers of individuals along the outfall transect and that practically all of the additional species in this area near shore are of the intolerant or facultative organism groups.

On Page 71 of the Argonne Report it is stated that, during winter operations of the Palisades Plant, about 17,000 gpm of discharge water will be withdrawn from the discharge canal and returned to the intake. So that this statement will not be misinterpreted, we would point out that the return water will actually be discharged to the onshore forebay and will not be transported to the intake structure located in the lake.

On Page 75 of the Argonne Report reference is made to entrainment studies at the Big Rock Point Plant during November, 1971 and the statement in the EPA report on the study that the plants involved were chosen because of their proximity to whitefish spawning grounds.[15] So far as we know there has been no additional information available on the location of whitefish spawning grounds since the representative of the U.S. Bureau of Sport Fisheries and Wildlife testified at the Wednesday session of the Conference Workshop in September, 1970 that no one has identified a whitefish spawning ground along the eastern shore of Lake Michigan. Further, the EPA study at Big Rock Point did not detect any whitefish eggs.

With regard to the zooplankton investigations from the same EPA study, the quote regarding the Big Rock Point data that "Regardless of whether the mortality is 29 or 55%, there appears to be significant population mortality" doesn't recognize the variability of the data or its true significance with regard to effects on other aquatic life. In fact, from the data included in the report it is not possible to derive the indicated population mortalities. Live/dead zooplankton ratios for Copepoda are the only figures included in the report and vary at the time of collection from 0.29 to 1.45 for intake samples and from 0.11 to 1.23 for the discharge samples. In addition, some of the intake-discharge paired samples were obviously taken during transition periods of zooplankton populations and should not be averaged with more representative samples. Moreover, the significance of any such observations cannot, of course, be determined by looking at changes in only one isolated group.

On Page 77 of the Argonne Report is reference to fish entrainment data for the intake at the Palisades Plant. It should be noted that continuous records of fish entrainment are being obtained and that totals up through July 1, 1972 are included in the report to the AEC of Environmental Impact of Plant Operation up to July 1, 1972.

On Page 109, Section 10, of the Argonne Report there is reference to testimony, given at the Michigan hearings, pertaining to the cost of providing cooling towers on Consumers' system.[16] The paragraph should be corrected to read:

> Dr. John Z. Reynolds, Consumers Power Company, testified at the Michigan hearings concerning the cost of outfitting Consumers' 7500 - MWe system, present and proposed, with towers. He estimated that $76,000,000 would be required in capital costs and $73,000,000 additional would be required for replacement capacity to account for the 3-5% system-capacity losses. Total annual costs, including fixed charges, added fuel costs, and operating and maintenance costs were estimated to be about $31,000,000 per year. Total capital costs, including equivalent costs escalated to a reasonable date of completion, were projected to be about $244,000,000.

A great deal of detailed enumeration of chemical effluents is presented in the Argonne Report in Table 11 on Page 111. These figures are largely prorated estimates based on data from only a few plants. While it is not claimed these are necessarily dissimilar plants, it should be recognized that this basis of estimating may be grossly in error and that any substantial action that depends on such data should await more accurate determinations.

In concluding, we would urge the Conferees to reconsider the weight of the technical evidence on the thermal question and adopt a position that actually involves a case-by-case evaluation of power plants using Lake Michigan waters for cooling. Unfortunately, the memo of John Quarles, Jr., Assistant Administrator for Enforcement and General Counsel of EPA, to the Regional Administrators on Policy on Thermal Effluent, dated May 12, 1972, does not require reasonable case-by-case evaluation for all discharges. Mr. Quarles presumes a need for "thermal pollution control" for all new plants and thereby precludes a reasonable examination of the relevant factors in these cases.

Much work has been conducted in the evaluation of thermal discharges and other power plant usages of water since the 1970 Workshop of the Conference. We are aware of no instance where an independent review of plants on Lake Michigan has resulted in the conclusion that once-through cooling has had significant adverse effects on the aquatic environment. Moreover, significant questions have been raised as to whether alternatives are potentially more damaging to the environment than once-through cooling. We are confident that the conferees will proceed with a careful evaluation of all the recent studies and base any findings and conclusions on a considered weighing of the technical evidence.

REFERENCES CITED

1. "Report of The Environmental Protection Agency to The Lake Michigan Enforcement Conference on Thermal Question," U.S. Environmental Protection Agency, September, 1972.

2. "Recommendations of The Lake Michigan Enforcement Conference Technical Committee on Thermal Discharges to Lake Michigan," January, 1971.

3. "Reconvening of the Third Session of the Conference in the Matter of Pollution of Lake Michigan and its Tributary Basin in the States of Wisconsin, Illinois, Indiana and Michigan" - - Volume I, Transcript, March 23, 1971, Pages 16-17.

4. "Summary of Recent Technical Information Concerning Thermal Discharges into Lake Michigan," Argonne National Laboratory, Contract Report 72-1 August, 1972.

5. Stewart, S. R., Brown W. L., and Polcyn, F. C., "Multi-spectral Survey of Power Plant Thermal Effluents in Lake Michigan," Willow Run Laboratories, The University of Michigan, April, 1972, Page 94.

6. Ayers, J. C., et al, "Benton Harbor Power Plant Limnological Studies Part X: Cook Plant Preoperational Studies 1971," Special Report No 44, Great Lakes Research Division, The University of Michigan, August, 1972.

7. "Supplemental Information on Environmental Impact of Palisades Nuclear Plant," Consumers Power Company, August 18, 1971.

8. "Environmental Impact of Plant Operation up to July 1, 1972 - Consumers Power Company, Palisades Plant," Consumers Power Company, July 19, 1972.

9. "1970 Water Quality Studies" by Consumers Power Company Environmental Activities Department.

10. "1971 Water Quality Studies" by Consumers Power Company Environmental Activities Department.

11. "1970 Biological Survey of Lake Michigan near Holland, Michigan," for Consumers Power Company, T. W. Beak Consultants, Ltd, November, 1970.

12. "1971 Biological Survey of Lake Michigan near Holland, Michigan," for Consumers Power Company, Beak Consultants, Inc, April, 1972.

13. "Identification of Miscellaneous Fish and Artificial Substrate Samples - 1971" for Consumers Power Company, Beak Consultants, Inc, April, 1972.

14. "Biological Survey of Lake Michigan in the Vicinity of the Consumers Power Company's Campbell Plants Thermal Discharge - August 11-13, 1970," Michigan Department of Natural Resources, January 22, 1971.

15. "Lake Michigan Entrainment Studies, Big Rock Nuclear Power Plant, Escanaba Power Plant, November-December, 1971," Environmental Protection Agency, January, 1972.

16. "Michigan Water Resources Commission Public Hearing on Proposed Revision to Interstate and Intrastate Temperature Standards for Protection of Fish and Aquatic Life," Statement by Consumers Power Company, June 24, 1971.

MR. PETERSEN: We have also presented a copy of the record of the hearing in the State of Michigan on standards. In addition to the regular hearing record, there is also a copy of the scientific papers which were presented for the record following the hearing and were made a part thereof.

MR. MAYO: May I try to make a distinction that would be acceptable to you, Mr. Petersen?

May we take the material supplemental to your statement and have it introduced as an exhibit so that we aren't faced with the burden of reproducing it?

MR. PETERSEN: By all means.

(The documents above referred to are on file at U.S. EPA Headquarters, Washington, D. C., and Region V Office, Chicago, Illinois.)

MR. PETERSON: The Report of the Environmental Protection Agency to the Lake Michigan Enforcement Conference on (the) Thermal Question, September 1972, provides a brief section as background on the history and workings of the conference. While it would not be appropriate to give a critique on the entire history, the remarks concerning the last session, which occurred on March 23-25, 1971, do require comment.

It is stated that the report of the Technical

Committee authorized at the October 29, 1970, Executive Session was presented at the March 23-25, 1971, session and then "on the basis of full discussion on the question, the conferees made certain findings and recommendations" which were subsequently approved by the EPA Administrator.

In fact, at the March 23-25 conference the Federal conferee presented a new position, prior to any discussion, and quite unrelated to the Technical Committee report. That position was pushed through the conference before it could be carefully evaluated, with the Federal conferee explaining that the EPA position was that it was anxious to have the States employ the EPA "recommendations" and would "employ the full extent of the administrative and the legislatively defined processes that are available to the Environmental Protection Agency to achieve that end." The arbitrary circumstances under which the findings and recommendations at the last conference were promulgated should cause no one to wonder that the States have in large measure rejected them.

We would also take issue with the inference on page 11 and in Tables I-IV that the latest recommendations of the Enforcement Conference are "established requirements." The recommendations of the conference are only that and require the regulatory authority of the States for implementation. In this regard, it is our position that the procedure for enforcing Enforcement Conference recommendations, contained in the Refuse Act regulations, is invalid.

Now, there are some comments, which are not in the paper which we have presented, that we would like to make very briefly on the paper presented by the Fish and Wildlife Administrator of the Environmental Protection Agency, on which we had no opportunity for cross examination and which paper we have not yet received.

However --

MR. MAYO: Excuse me, Mr. Petersen. Are you referring to Mr. Yates Barber's material?

MR. PETERSEN: Yes, sir, I am.

MR. MAYO: Okay. In point of clarification, Mr. Barber is with the Department of the Interior --

MR. PETERSEN: I thought he had identified --

MR. MAYO: -- Fish and Wildlife Service.

MR. PETERSEN: -- that as being under the Environmental Protection Agency in his statement this morning.

MR. MAYO: No, I think he identified himself as an Environmental Advisor in the Bureau of Sport Fisheries and Wildlife, Department of the Interior.

MR. PETERSEN: Thank you for bringing that to my attention.

In any event, it was our observation that the paper was in large part based upon theoretical facts which were not applicable as used; that that was based upon unjustifiable extrapolation of data; and that the figures on theorized damage were not placed in appropriate context; in addition to which, I might comment that the newspapers are hardly a scientifically sound source of data.

MR. MAYO: You are going to insult Casey Bukro, Harlan Draeger, and a few other fellows in Chicago. (Laughter)

MR. PETERSEN: I am not intending to insult anyone, I am merely commenting upon a paper. My intention is to --

MR. McDONALD: Well, all of the reporters are smiling, if that means anything. (Laughter)

MR. MAYO: Excuse the interruption.

MR. PETERSEN: That's all right.

There are some items of technical information upon which we would like to comment as the result of a review by Consumers Power Company's technical experts. Some involve relatively minor corrections or elaborations on the "Argonne Report" and the others are to advise you of additional information that might be considered in this review.

Beginning on page 8 and again on page 36 of the Argonne Report, mention is made of a study and report by the University of Michigan Willow Run Laboratories involving numerous multispectral aerial scanning observations along the eastern shore of Lake Michigan during the spring thermal bar development period in 1971. The powerplants covered included the J. H. Campbell plant, the Michigan City plant and the Bailly plant. The project involved 17 separate flight lines and a total of 80 sets of data for all of the lines, the processing of which "showed no evidence of any water masses that could be attributed to the effect of warm water discharges from powerplants into the lake."

We believe the importance of this work warrants its inclusion into the record of the conference. The original copies include a large number of color photographs which would aid the reader in interpretation. However, the black and white copies which should have been given to you already show or describe the major features of interest. A color copy will be furnished the conference by Joseph Dominick, Esq., on behalf of I & M.

It should also be noted that in connection with the Willow Run aerial flights, numerous water samples were collected by field personnel for correlative study. Detailed phytoplankton data and other water quality observations are included in the Benton Harbor Powerplant Limnological Studies, Part X, Cook Plant Preoperational

Studies 1971, Special Report No. 44, Great Lakes Research Division, the University of Michigan, August 1972.

At this point, I will skip a large portion of what I had prepared, which is being included in the record.

In concluding, we would urge the conferees to reconsider the weight of the technical evidence on the thermal question and adopt a position that actually involves a case-by-case evaluation of powerplants using Lake Michigan waters for cooling. Unfortunately, the memo of John Quarles, Jr., Assistant Administrator for Enforcement and General Counsel of EPA, to the Regional Administrators on Policy on Thermal Effluent, dated May 12, 1972, does not require reasonable case-by-case evaluation for all discharges. Mr. Quarles presumes a need for "thermal pollution control" for all new plants and thereby precludes a reasonable examination of the relevant factors in these cases.

Much work has been conducted in the evaluation of thermal discharges and other powerplant usages of water since the 1970 workshop of the conference. We are aware of no instance where an independent review of plants on Lake Michigan has resulted in the conclusion that once-through cooling has had significant adverse effects on the aquatic environment. Moreover, significant questions have been raised as to whether alternatives are potentially more damaging to the environment than once-through cooling. We are confident that the conferees will proceed with a careful evaluation of all the recent studies and base any findings and conclusions on a considered weighing of the technical evidence.

Thank you.

MR. McDONALD: Mr. Petersen.

MR. PETERSEN: Yes.

MR. McDONALD: Knowing your love of the newspapers, I would like to point out that in your exhibit that you presented of your hearings of the Michigan Water Resources Commission you did include copies of newspaper articles.

(Laughter)

MR. PETERSEN: I included a reference to -- correction -- what I included was the entire record of the conference as prepared by the Michigan Water Resources Commission, without editing, and I will assure you that, in fact, I do love the newspapers. I take two of them, and I find them very enjoyable and a source of never-ending information. But I do challenge them as a scientific, accurate source of data.

MR. MAYO: A point of information, Mr. Petersen.

Do you desire the Willow Run report to be a part of the record or submitted as an exhibit?

MR. PETERSEN: I think probably because of its bulk, it would be better accepted as an exhibit.

MR. MAYO: Thank you.

(The document above referred to is on file at U.S. EPA Headquarters, Washington, D. C., and Region V Office, Chicago, Illinois.)

MR. McDONALD: I don't want to pursue this newspaper argument but it seems to me that what Mr. Barber had in his report was news. When you get a fish kill involving hundreds of thousands of fish, there is not much scientific evidence involved there; it is a fish kill. And usually a picture accompanies that type of situation. So I really think that casting credibility on his report because it happened to be newsworthy is not really germane to the issue.

MR. PETERSEN: I am sorry. I have not been able to see the report to see if it attributes hundreds of thousands of fish to the newspaper report. I think that the only place that I recall hearing hundreds of thousands of fish was a report that there must have been from -- or accepted from the Michigan Water Resources Commission which accepted some individual plant's estimate of what he thought might have been the case as far as the fish kill was concerned. It didn't even come from the newspapers, to the best of my recollection.

MR. McDONALD: Well, sir, let me ask you, in terms of fish kills: Do you keep records of fish kills over entrainments that relate to your Campbell powerplant and your Palisades plant in Michigan?

MR. PETERSEN: I hate to answer a question yes and no. Obviously each individual fish that is impinged upon a screen anywhere in the system is not necessarily made a matter of record. On the other hand, we make every attempt to make a full record and investigate any unusual occurrence. Obviously the occurrence to which Mr. Barber made reference, as to the Campbell plant, is an unusual occurrence and something of a vastly lesser magnitude would have been an unusual occurrence of which we would have attempted to make a full record and investigation.

MR. McDONALD: What do you classify as a power company representative as an unusual occurrence regarding a fish kill?

MR. PETERSEN: As far as impingement upon the screen is concerned, when we reach a point where the people who are changing the screen observe a large number of -- and extraordinarily large number of fish on the screen, because obviously there are going to be one or two fish, in many circumstances -- they may have been dead when they go there -- but they should be reported.

Now, I do not have the records in this regard. I do have -- correction -- I have Dr. John Z. Reynolds with me, who has been active in constructing the plants in regard to this matter. I would be very happy to have him come up to the stand if you would like to question him concerning this matter. But the standing instructions to the plant are to report to the environmental people so we can immediately pass the information on to the Michigan Water Resources Commission and also send a biologist to the scene to attempt to ascertain the damage, and to ascertain what occurred to cause this damage, if possible.

MR. McDONALD: Well, Mr. Barber, in his report, listed at least two significant kills involving up to 550,000 fish at Palisades and several hundred thousand at Campbell.

Are there other kills of significance --

MR. PETERSEN: I am sorry. I am not aware of a 550,000 fish kill at Palisades. Perhaps I missed something somewhere along the line.

MR. McDONALD: Page 11 of Mr. Barber's report.

MR. PETERSEN: As I told you, I haven't received a copy of the report, and perhaps I wasn't able to hear at that particular place.

MR. McDONALD: Well, let me not burden you, then, with that report.

Let me ask you --

MR. PETERSEN: I think you are speaking about the fourth line?

MR. McDONALD: Yes.

MR. PETERSEN: I think -- I have been able to borrow a copy here, and I think that the correction has been made in this copy of the report reducing it by one magnitude, 55,000 fish over a period of time -- a certain period of time.

MR. MCDONALD: Fifty-five thousand.

MR. PETERSON: Fifty-one thousand, according to this; 51,235 fish, weighing 4,995 pounds removed from intake screens from the Palisades nuclear generating plant during the period May 16 to August 25, 1972. That's the way it reads in this report which was handed to me as corrected.

MR. McDONALD: Well, I assume that the report Mr. Barber gave us has a typographical error.

MR. BARBER: Yes.

MR. McDONALD: He said yes, there is an error.

MR. BARBER: I think all copies have been corrected but probably that one you have has not. (Laughter)

MR. McDONALD: That is very charitable of you,

O. Petersen

Mr. Barber.

MR. MAYO: That's like winning a million dollars in a lottery in New York.

MR. McDONALD: It does make 51,000 fish sound relatively small compared to a half million.

MR. PETERSEN: I am not adequately qualified to make a judgment as to whether 51,000 fish is large or small. Dr. Benda is making a study of this matter and has produced a report.

MR. McDONALD: I guess what I am trying to say here, Mr. Petersen, is I am wondering whether you do tabulate entrainments and kills and quantify these so that there is a record of what is going on, and then to whom do you report these? Is there such a mechanism available? Is it being used?

MR. PETERSEN: Certainly at the Palisades plant, yes. We have been taking records of the fish killed since -- well, since before last January -- I can't recite the precise date upon which we began to make records of the fish which were impinged upon the screens.

MR. McDONALD: Would it be possible to have that information submitted in tabular form to the conference?

MR. PETERSEN: Certainly. You will not have it today, however.

MR. McDONALD: The record will be open for a week if you could submit it.

MR. PETERSEN: I would be pleased to do so.*

MR. McDONALD: One other question I have relates to something I talked with Mr. Purdy about when he was giving his statement.

Mr. Purdy was talking overall lake impact for a given discharge. Do you, as a power company representative, feel any responsibility for keeping up with the other power companies to relate your total discharges to total lake impact? Or should these be discussed on an individual basis and let the regulatory agencies assess the total lake impact?

MR. PETERSEN: We try to assess fully the impact of what we are doing, both locally and as an effect upon the ecosystem; and in assessing the ecosystem we necessarily would have to take into consideration the effect upon the whole lake, because, to some extent, as I am informed by my scientific colleagues, the ecosystem of Lake Michigan is interrelated.

MR. McDONALD: How do you make that total lake assessment, Mr. Petersen?

MR. PETERSEN: I don't. I turn to my scientific colleagues, try to give them the benefit of all of the

*(The document follows this page.)

Consumers Power Company

J. Z. Reynolds
Director of Environmental Planning

General Offices: 212 West Michigan Avenue, Jackson, Michigan 49201 • Area Code 517 788-0550

September 28, 1972

Messrs. Francis Mayo - EPA, Chicago Region V
James McDonald - EPA, Chicago Region V
Ralph Purdy - Michigan Water Resources Commission
William Blaser - EPA, Illinois
Thomas Frangos - Wisconsin Dept of Natural Resources
Perry Miller - Indiana Stream Pollution Control Board

Gentlemen:

During the Lake Michigan Enforcement Conference afternoon session on September 21, 1972, the EPA Conferee, Mr. McDonald, inquired of Mr. O. K. Petersen, Senior Attorney for Consumers Power Company, as to the availability of data on fish collected on the intake screens of the Palisades Plant. In response to this inquiry, I am enclosing two items for your information.

The paper "Thermal Effects Studies at the Palisades Nuclear Plant -- Preliminary Findings from the First Few Months of Operation," was quoted by Mr. Yates Barber, U.S. Bureau of Sport Fisheries and Wildlife, as to the total numbers of fish collected on the screens from May 16, 1972 to August 25, 1972. The distribution of fish by species, number and weight is given in Table 3. Figure 2 indicates the weekly totals for the three dominant species for the period indicated. Dr. Benda, the author, is a consultant to Consumers Power Company.

The second item is Section II-E, FISH, of a document entitled "Palisades Plant, Special Report, Environmental Impact of Plant Operation up to July 1, 1972" which was filed with the U.S. Atomic Energy Commission by Consumers Power Company on July 19, 1972. The report includes daily tabulations of fish species collected on the plant intake screens between January 23, 1972 and May 16, 1972 and weekly tabulations from May 16, 197 to July 1, 1972. Weekly tabulations subsequent to July 1, 1972 will be reported as a part of semiannual submittals to the U.S. Atomic Energy Commission. The report also contains data on other fish collections in 1972 as well as a description of the entire fish sampling programs at the plant.

Yours very truly,

J Z Reynolds

JZR/pgk
Enc.

Thermal Effects Studies at the Palisades Nuclear Plant

Preliminary Findings From the First Few Months of Operation

By

Robert S. Benda, Ph D
Assistant Professor
Aquinas College
Grand Rapids, Michigan

American Fisheries Society
National Meeting
Hot Springs, Arkansas

September 10, 1972

INTRODUCTION

This paper summarizes the results of the first four months of study of the effects of the thermal discharge from the Palisades Nuclear Generating Plant. The plant is located in Van Buren County on a 487-acre site on the eastern shore of Lake Michigan in the southwestern part of Michigan. The site is approximately 4-1/2 miles south of South Haven and 16 miles north of Benton Harbor and St Joseph (Figure 1).

The Palisades facility, which has a rated capacity of about 700 megawatts electric (MWe) with an ultimate electrical output up to 821 MWe, began operations at 60% of rated power early in 1972. The plant utilizes a pressurized water nuclear reactor system and the steam is condensed by means of a once-through condenser cooling system using Lake Michigan water to dissipate the waste heat. The waste heat at rated capacity will increase the cooling water temperature a maximum of 25°F above ambient at the intake. The intake is submerged offshore about 3, 300 feet at a minimum depth of about 25 feet. The heated discharge enters Lake Michigan directly at the shoreline. The total flow rate through the once-through cooling system is about 405, 000 gallons per minute (gpm). This system will be in use until completion of mechanical draft evaporative cooling towers in early 1974. These towers will convert the circulating water system to essentially closed cycle cooling with only a small blowdown discharge to the lake which will be no more than 5°F above ambient lake temperature.

SCOPE OF THE STUDY

Consumers Power Company has undertaken to study the effects of the thermal discharge until completion of the cooling towers. The study includes the following areas:

1. Temperature
    - A. Continuous Intake and Discharge
    - B. Thermal Plume Measurements
2. Chlorine Residuals
3. Benthos and Psammon Community
4. Phytoplankton
    - A. Mortality
    - B. Distribution and Abundance
5. Zooplankton
    - A. Mortality
    - B. Distribution and Abundance
6. Fish
    - A. Mortality
    - B. Distribution and Abundance
    - C. Spawning Sites
    - D. Juvenile Fish Use of Nearshore Areas
7. Attached Algae and Rooted Aquatics

Temperature

The maximum temperature increase of the discharge water above ambient thus far has been about 28°F, during short periods when only one of the two circulating water pumps was in operation, but the normal increase in temperature at 60% power has been about 15°F.

The thermal plume measurements thus far show considerable variation in size, shape and direction depending upon wind and current conditions. Temperature measurements in the lake have shown the typical buoyant thermal plume configuration with detectable effects on surface temperature influencing areas in the range of about 100 acres to nearly 900 acres.

Chlorine Residuals

Thus far, it has not been necessary for the plant to chlorinate its condensers, so no chlorine effects have been studied. It is intended that during chlorination extensive measurements of chlorine residuals in the lake will be made to correlate with collections of plankton and observations of fish reactions. Several chlorine demand tests have been conducted on lake water showing a range of .308 to .75 ppm for 70 minutes incubation at ambient intake temperature. The average chlorine demand is about .55 ppm for all tests conducted.

Benthos and Psammon Community

Lake benthos have been collected using a ponar dredge at about 30 sampling stations for the past 4 years which will be compared to benthos similarly collected during operation of the plant. Samples are also being collected of the psammon community along the shoreline with a core sampler to determine effects on organisms residing in this zone. At the present time, there are not sufficient data available from any of the bottom collections for evaluation.

Phytoplankton

Carbon 14 tests (Table 1) are being conducted to determine if any loss of photosynthetic activity occurs as a result of the once-through cooling process. Thus far, the photosynthetic activity in the samples has varied from a gain of 105% in the discharge over the intake sample to an 81% loss in the discharge over the intake water. The results have not been consistent and show considerable variation. Out of 12 tests conducted on a heated discharge, three have shown more activity or no loss in activity in the discharge sample when compared to the intake sample, but the majority (9 of 12) do show losses in activity ranging from 11% to 79%. The tests have also been conducted when no heat was being added and one of the two tests showed no loss in activity in the discharge sample, while the other showed a loss of 13% in the discharge sample.

The dominant algal group observed in the intake water samples has been the diatoms, especially Tabellaria fenestrata, Fragillaria crotonensis, Melosira sp, and occasionally the flagellate Dinobryon sp.

Zooplankton

Tests have been conducted (Table 2) to determine mortality rates of zooplankters in the discharge water by using the vital stain neutral red. Thus far, mortalities have remained below 30% in the discharge as compared to the intake. As with the phytoplankton tests, both heated water discharge samples and nonheated water samples have been collected. In all samples examined to date, a higher percentage of the zooplankters have been dead in the heated samples as compared to the unheated samples.

In late spring and early summer, the dominant organisms in the samples were the cyclopoid copepods, but as summer progressed, the *Bosmina* cladocerans have become the dominant group, especially *Bosmina longirostris* and *Bosmina coregoni*. *Asplanchna* sp. and *Kellicottia longispina* are the most dominant rotifers collected to date.

Fish

The fish have been divided into several areas of study. These are as follows:

Entrainment - Fish entering the submerged intake structure are eventually impinged on traveling screens and washed into a collection basket. Thus far, the Alewife, *Alosa pseudoharengus*, Perch, *Perca flavescens*, Spottail shiner, *Notropis hudsonius*, and Slimy sculpin, *Cottus cognathus* have been the most frequently observed fish passing through the screens (Table 3 and Figure 2). The salmonids and other game species have been observed in very low numbers.

Seining and Trawling - The results of seining and trawling collections and visual observations show the Alewife, Carp, *Cyprinus carpio*, Spottail shiner, and Perch are more numerous in the heated water area than in the unheated areas, and salmonids are found in the unheated areas, but not the heated area.

The August seining collections in all five collection areas contained numerous Alewife and Spottail shiner young of the year with no larger concentrations being observed or collected in the heated water area.

Eggs and Larvae - The intake water has been sampled periodically by suspending a #20 mesh plankton net to collect fish eggs and larvae. Over the summer, less than 1,000 eggs and five larvae have been collected in over 300 hours of sampling and about 3,400,000 gallons of water. At this time, it does not seem that the intake structure is located in an area of high fish reproduction activity.

Attached Algae and Rooted Aquatics

No large concentrations of attached algae, such as Cladophora, have been observed in the area of the heated discharge, as opposed to unheated areas. Underwater transects of the bottom in the vicinity of the plant will be made yet this year to determine the presence of rooted aquatics in the area of influence of the plant.

Summary

The plant is still operating at only 60% power and some aspects of the study effort are still in the initial stages of investigation. While some environmental effects are apparent and are being measured, definite conclusions as to their significance should await further collection and interpretation of data.

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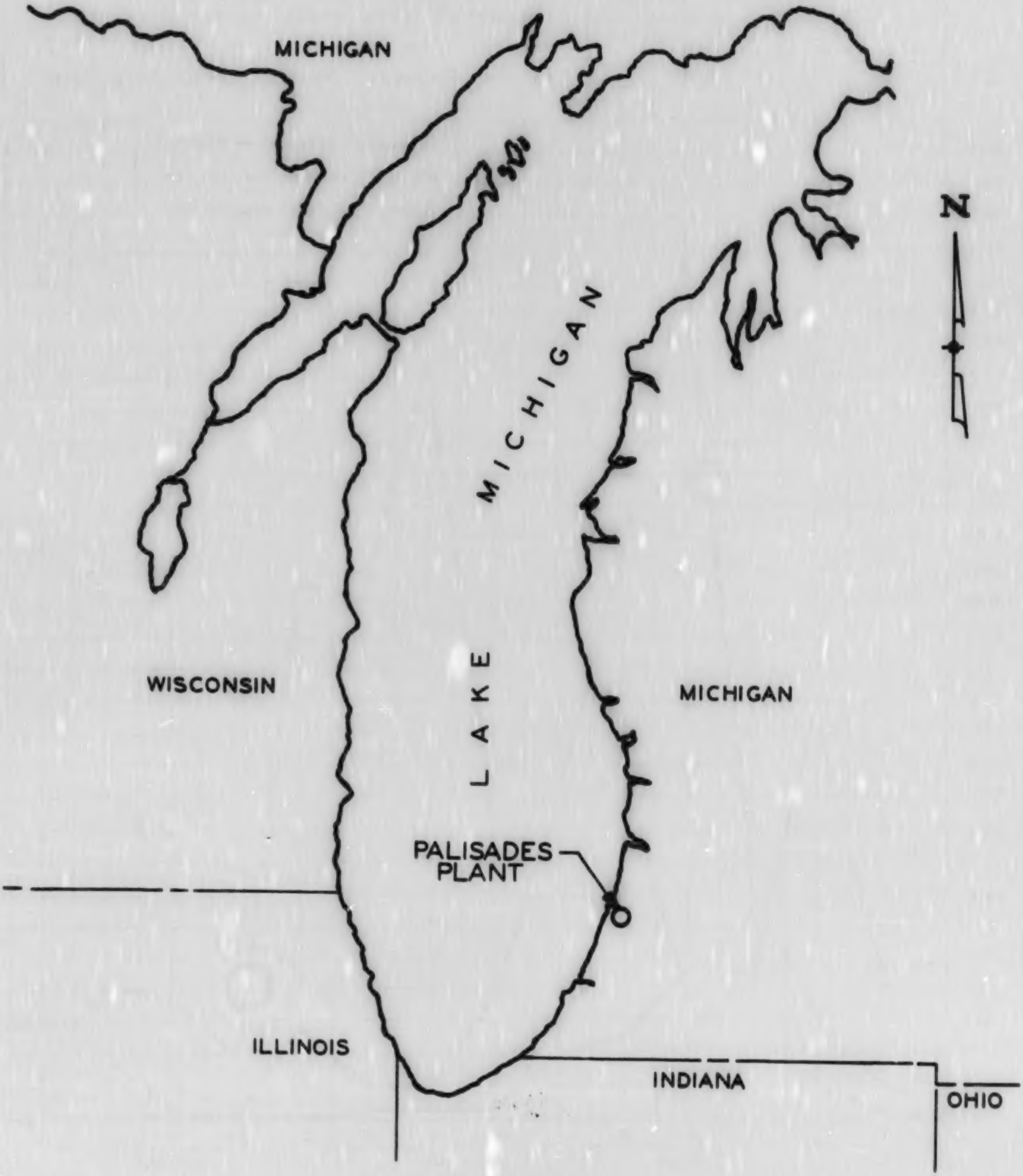
MICHIGAN
N
LAKE MICHIGAN
WISCONSIN
MICHIGAN
PALISADES PLANT
ILLINOIS
INDIANA
OHIO

FIGURE 1

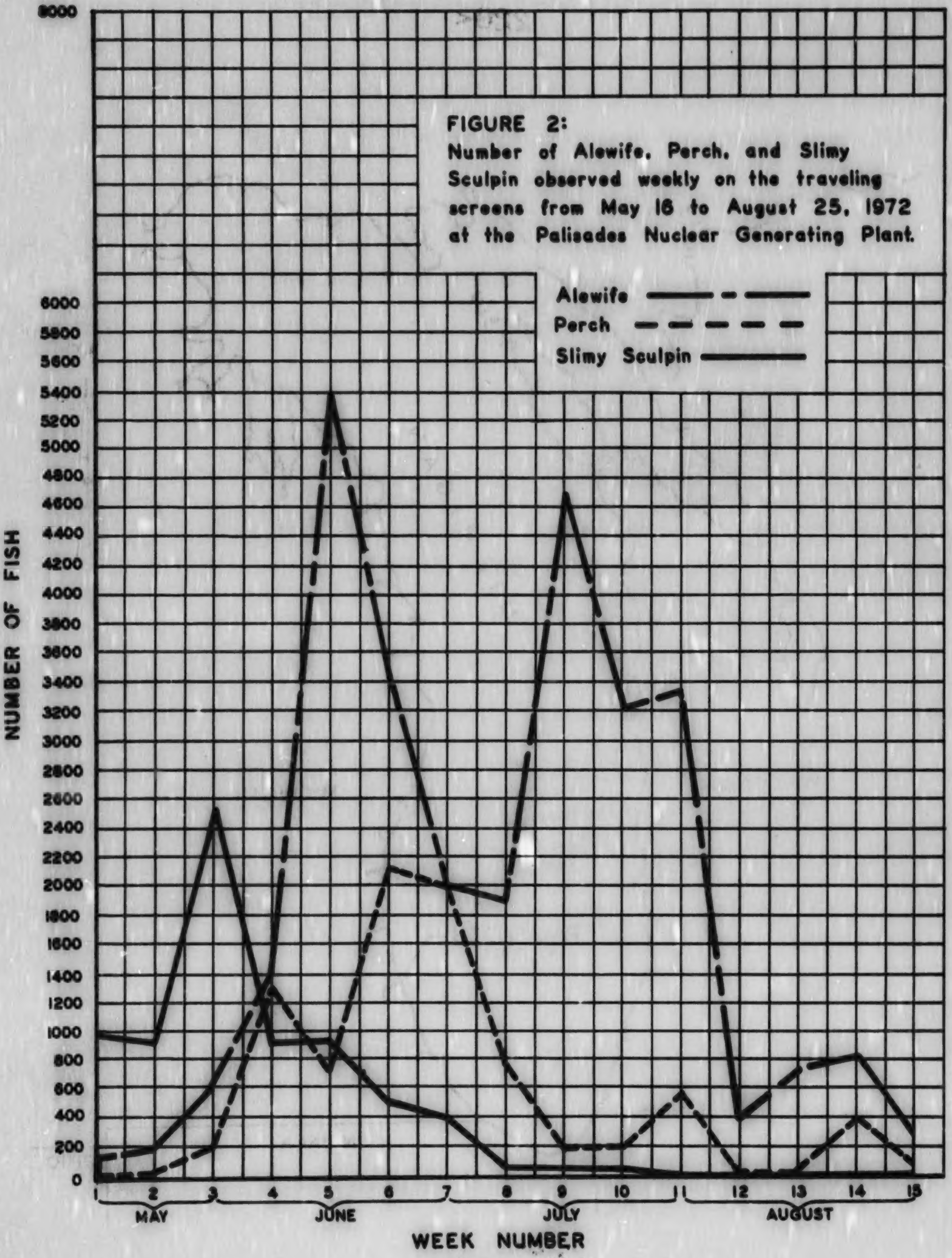

FIGURE 2:
Number of Alewife, Perch, and Slimy Sculpin observed weekly on the traveling screens from May 16 to August 25, 1972 at the Palisades Nuclear Generating Plant.

TABLE 1 Photosynthetic Activity in the Intake and Discharge Water Samples

Date	Sample	Sample Temp (oF)	Incubation Temp (oF)	Photosynthetic Activity (picocuries)	Reduction in Photosynthetic Activity	Heated Discharge
May 24, 1972	Intake	44	44	1,264	-10.04*	No
	Discharge	44		1,391		
June 2, 1972	Intake	56	56	3,041	13.42	No
	Discharge	56		2,633		
June 13, 1972	Intake	56	56	1,901	65.44	Yes
	Discharge	70		657		
June 15, 1972	Intake	54	54	3,463	47.48	Yes
	Discharge	70		1,819		
June 16, 1972	Intake	58	58	2,278	-0.57*	Yes
	Discharge	72		2,291		
July 14, 1972	Intake	64	64	766	34.21	Yes
	Discharge	84		504		
July 14, 1972	Intake	64	64	1,364	-1.24*	Yes
	Discharge	84		1,381		
July 14, 1972	Intake	64	64	1,730	79.02	Yes
	Discharge	84		363		

TABLE 1 Cont'd

Date	Sample	Sample Temp (°F)	Incubation Temp (°F)	Photosynthetic Activity (picocuries)	Reduction in Photosynthetic Activity	Heated Discharge
July 21, 1972	Intake	74	74	3,785	52.48	Yes
	Discharge	91		1,799		
July 21, 1972	Intake	74	74	2,192	-63.41*	Yes
	Discharge	91		3,582		
August 4, 1972	Intake	45	45	321	10.9	Yes
	Discharge	62		286		
August 4, 1972	Intake	45	45	187	24.6	Yes
	Discharge	62		141		
August 4, 1972	Intake	45	45	308	23.06	Yes
	Discharge	62		237		
August 17, 1972	Intake	64	64	299	29.10	Yes
	Discharge	82		212		

* Indicates an increase in photosynthetic activity in the discharge samples over the intake samples.

TABLE 2

PALISADES PLANT

Percent Mortality of Zooplankton Organisms from Intake & Discharge Water

					Zooplankton Groups								
Date Time	Heated	Sample Number & Location	Intake Temp (^{O}F)	Discharge Temp (^{O}F)	Copepoda Live	Copepoda Dead	% Dead or Mortality	Cladocera Live	Cladocera Dead	% Dead or Mortality	Rotifera Live	Rotifera Dead	% Dead or Mortalit
May 16		1(Intake)	49		140	31	18	38	9	19	16	2	11
10:00 AM	No	1(Disch)		50	126	33	21	68	18	21	29	4	12
		2(Intake)	49		103	19	16	63	12	16	13	7	35
	No	2(Disch)		50	97	31	24	57	13	19	19	6	24
Intake Totals					243	50	17	101	21	17	29	9	24
Discharge Totals					223	64	22	125	31	20	48	10	17
Average Loss Discharge Over Intake							+5			+3			-7
June 9		1(Intake)	54		168	27	14	50	11	18	28	7	20
9:30 AM	Yes	1(Disch)		65.5	159	60	27	45	21	32	31	11	26
		2(Intake)	54		100	13	12	45	7	13	11	0	0
	Yes	2(Disch)		65.5	133	57	30	77	41	35	23	3	12
Intake Totals					268	40	13	95	18	16	39	7	15
Discharge Totals					292	117	29	122	62	34	54	14	21
Average Loss Discharge Over Intake							+16			+18			+6

TABLE 3 Total number of fish collected from the traveling screens at the Palisades Nuclear Generating Plant from May 16 to August 25, 1972.

Species	Total Number	Total Weight (lbs)
Alewife	28,272	2,262
Coho Salmon	12	3
Chinook Salmon	1	13
Lake Trout	14	2
Brown Trout	1	1/2
Bloater	331	50
Smelt	610	23
Spottail Shiner	4,738	190
White Sucker	14	20
Longnose Sucker	207	159
Channel Catfish	17	4
Black Bullhead	29	7
Trout-Perch	748	30
Burbot	44	41
Nine-spine Stickleback	246	2
Slimy Sculpin	7,343	103
Perch	8,608	2,085
Totals	51,235	4,995

E. FISH

Effects of plant operation on fish life are very important indicators of apparent effects on the aquatic habitat. Fish are also the most visible element of the aquatic ecosystem and are of prime importance for public recreation. Fish sampling with gill nets, seines and trawls, both within and outside the area of the thermal plume will indicate, by their presence, the preferred location of the various fish species that inhabit the area. The above, in conjunction with bottom sampling and sampling the intake water with plankton netting, will identify spawning and nursery areas and potential effects of plant operation on fish reproduction in the area. Direct observations of fish collected on the intake screen indicate the species of fish within the area of the plant intake on a continuous and consistent basis as well as the direct effects of entrainment within the intake system. Notations of fish mortalities under normal operation and periods of chlorination will complement the systematic sampling of live fish and provide indications of directly lethal conditions.

Data from the various fish collection efforts are presented separately in the following sections. In total, 28 species of fish have been sampled and are listed in Table II-E-1. Seven species were not collected in the preoperational studies, but five species collected in those studies have not yet been sampled since plant operation began.

Fish Entrainment

The plant intake water is screened through 3/8-inch mesh traveling screens and all fish collected on the screens are sluiced to a collection basket where the fish are identified and counted on a

TABLE II-E-1
PALISADES PLANT

List of species of fish collected by seining, trawling, and entrainment on the traveling screens from January 23 to July 1, 1972.

Common Name	Scientific Name
Alewife	*Alosa pseudoharengus*
Chinook salmon	*Oncorhynchus tschawytscha*
Coho salmon	*Oncorhynchus kisutch*
[1] Brown trout	*Salmo trutta*
[1] Rainbow trout	*Salmo gairdneri*
Lake trout	*Salvelinus namaycush*
Whitefish	*Coregonus* Sp.
Cisco	*Coregonus artedi*
Bloater	*Coregonus hoyi*
Smelt	*Osmerus eperlanus mordax*
Northern pike	*Esox lucius*
Carp	*Cyprinus carpio*
Longnose dace	*Rhinichthys cataractae*
Spottail shiner	*Notropis hudsonius*
White sucker	*Catastomous commersoni*
Longnose sucker	*Catastomous catastomous*
Channel catfish	*Iclalurus punctatus*
Black bullhead	*Ictalurus melas*
Trout-perch	*Percopsis omiscomaycus*
Burbot	*Lota lota*
[1] Bowfin	*Amia calva*
[1] Nine-spine stickleback	*Pungitus pungitus*
[1] Slimy sculpin	*Cottus cognatus*
[1] Rock bass	*Ambloplites rupestris*
[1] Bluegill	*Lepomis macrochirus*
[1] Pumpkinseed	*Lepomis gibbasus*
Yellow perch	*Perca flavescens*
Johnny darter	*Etheostoma nigrum*

(1) Not sampled in preoperational studies.

E. **FISH** (Contd)

Fish Entrainment (Contd)

regular basis, usually at least once each day. The fish entrainment data compiled for this report are presented in two parts.

The data from January 23 to May 15, 1972 were gathered by plant maintenance personnel with the assistance of Consumers Staff Aquatic Biologist. During this period, only the total numbers and length of the fish were recorded as shown in Table II-E-2. However the average weights of some of the species can be evaluated from average weights for the same species recorded from May 16 to July 1, 1972 as follows:

	Number Per Weight
Spottail shiners	25/pound
Trout perch	25/pound
Alewife	12-1/2/pound
Sculpin	71/pound
Perch	4/pound

The fish entrainment collections after May 15 were made by environmental study personnel stationed at the site when more detailed studies of plant operation on lake biota were begun. Summaries of fish entrainment data, including weights, for the period May 16 to July 1, are given in Table II-E-3. The total number of fish collected on the screens for this 6-1/2 week period came to 32,148, with a total weight of 2,966 pounds. The 16 weeks of collection prior to May 16 accounted for a total of 2,220 fish. For the entire period, alewives account for about 40 percent of the total fish reported and perch account for about 18 percent.

The current procedure is to run the screens automatically every 12 hours and manually when conditions (ie, many fish) warrant it. The usual condition of the fish ranges from decomposing specimens to fish that are actively swimming. Most of the fish are dead or damaged. The damage to the fish is mostly mechanical and varies from open wounds to descaling and hemorrhaging.

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TABLE II-B-2
PALISADES PLANT
Number and Size of Fish Collected from
Intake Screens, January 23, 1972 to May 16, 1972

N = Number; L = Length in Inches

DATE		1-23	1-24	1-25	1-26	1-31	2-1	2-2	2-3	2-4
SPECIES										
ALEWIFE	N						25			200
	L						?			1-6
BURBOT	N			2	2	2		2	2	
	L			20,24	20	?		8,10	16	
CARP	N			11			2			
	L			3			3			
COHO	N					1		3		
SALMON	L					pieces		pieces		
LAKE	N									
TROUT	L									
BOWFIN	N					2	4			
	L					?	14			
PERCH	N		2	15	1			1		5
	L		4-5	3,7-10	6			3		10
SCULPIN	N	18	37	351	40	12	4	36	8	
	L	4	3-4	1-3	?	?	3-5	3-4	3-5	
SMELT	N			1	3			6		
	L			6	8			?		
RAINBOW	N			2	2				1	
TROUT	L			10	8-10				6	
SUCKER	N		2	6	2	1	2			
	L		18,4	12-20	16,20	24	4-6			
CHUB	N			1			1			
	L			6			3			
CHANNEL	N									
CATFISH	L									
CHINOOK	N									
SALMON	L									
CISCO	N									
TOTALS		18	41	389	50	18	38	48	11	205

TABLE II-B-2 (CONTD)
PALISADES PLANT
Number & Size of Fish Collected from Intake Screens, January 23, 1972 to May 16, 1972

N = Number; L = Length in Inches

DATE SPECIES		2-5	2-6	2-7	2-8	2-9	2-10	2-11	2-12	2-13
ALEWIFE	N	80		12					10	
	L	?		?					4	
BURBOT	N		3							
	L		?							
CARP	N									
	L									
COHO	N		1							
SALMON	L		pieces							
LAKE	N	1	2							
TROUT	L	14	16,28							
BOWFIN	N	3	4	2		2	5		1	1
	L	?	?	?		?	?		18	20
PERCH	N	17	5	5	1	4				
	L	6-10	?	?	8	?				
SCULPIN	N	80	80	90	25	25	32		18	8
	L	?	?	?	?	?	4		?	?
SMELT	N					1	10		4	
	L					?	3		8	
RAINBOW	N		1							
TROUT	L		14							
SUCKER	N	4	2	3	3		3			1
	L	9-19	20	10-20	15-18		10-20			20
CHUB	N									
	L									
CHANNEL	N									
CATFISH	L									
CHINOOK	N									
SALMON	L									
CISCO	N									
TOTALS		185	98	112	29	32	50	0	33	10

TABLE II-E-2 (CONTD)
PALISADES PLANT
Number & Size of Fish Collected from
Intake Screens, January 23, 1972 to May 16, 1972

N = Number; L = Length in Inches

DATE SPECIES		2-14	2-15	2-16	2-17	2-18	2-19	2-20	2-21	2-22
ALEWIFE	N									
	L									
BURBOT	N		2							
	L		18,25							
CARP	N									
	L									
COHO	N									
SALMON	L									
LAKE	N									1
TROUT	L									24
BOWFIN	N						3	2		
	L						13-18	15-16		
PERCH	N			1			2			1
	L			8			6,10			10
SCULPIN	N		5				27			
	L		4				3-5			
SMELT	N									
	L									
RAINBOW	N									
TROUT	L									
SUCKER	N		2	1			2	1		
	L		20	10			6,8	20		
CHUB	N									
	L									
CHANNEL	N			1						
CATFISH	L			8						
CHINOOK	N									
SALMON	L									
CISCO	N									
TOTALS		0	9	3	0	0	34	3	0	2

TABLE II-E-2 (CONTD)
PALISADES PLANT
Number & Size of Fish Collected from Intake Screens, January 23, 1972 to May 16, 1972

N = Number; L = Length in Inches

DATE		3-1	3-2	3-7	3-9	3-10	3-14	3-17	3-18	3-24
SPECIES										
ALEWIFE	N									40
	L									?
BURBOT	N						4			
	L						20			
CARP	N						1			
	L						10			
COHO	N									
SALMON	L									
LAKE	N									
TROUT	L									
BOWFIN	N		4		5	1		4	3	
	L		?		?	?		?	?	
PERCH	N		4		4	3	2	1	4	5
	L		?		?	6	4-6	?	?	6-8
SCULPIN	N		4	10	8		1	2	6	
	L		?	?	?		?	?	?	
SMELT	N									1
	L									?
RAINBOW	N			1		1	1	1		
TROUT	L			?		20	10	?		
SUCKER	N								3	2
	L								?	24
CHUB	N									1
	L									18
CISCO	N									2
	L									
CHINOOK	N	1								
SALMON	L	22								
	N									
TOTALS		1	12	11	17	5	9	8	16	51

TABLE II-E-2 (CONTD)

PALISADES PLANT

Number & Size of Fish Collected from
Intake Screens, January 23, 1972 to May 16, 1972

N = Number; L = Length in Inches

DATE SPECIES		3-25	3-26	3-29	4-20	4-24	4-27	4-29	5-2	5-4
ALEWIFE	N	4				20	204	10	8	25
	L	?				4	4	4-5	?	4
BURBOT	N					1				
	L					20				
CARP	N									
	L									
COHO SALMON	N			1						
	L			23						
LAKE TROUT	N				1					
	L				28					
BOWFIN	N		8							
	L		20							
PERCH	N	1		6						
	L	?		5						
SCULPIN	N		1			1			1	1
	L		?			12			?	8
SMELT	N		2							
	L		4-6							
RAINBOW TROUT	N	1							40	
	L	?							?	
SUCKER	N		1							
	L		20							
CHUB	N					1	1	1		
	L					24	10	10		
CHANNEL CATFISH	N									
	L									
CHINOOK SALMON	N									
	L									
CISCO	N									
TOTALS		6	12	7	1	23	205	11	49	26

TABLE II-B-2 (CONTD)
PALISADES PLANT
Number & Size of Fish Collected from
Intake Screens, January 23, 1972 to May 16, 1972

N = Number; L = Length in Inches

DATE SPECIES		5-5 5-6	5-7	5-8	5-10	5-14	5-16	TOTAL 1-23 thru 5-16
ALEWIFE	N	201	50	20	35	15	8	
	L	4-5	4-5	4-5	4-5	4-5	?	967
BURBOT	N							
	L							20
CARP	N							
	L							14
COHO SALMON	N							
	L							2
LAKE TROUT	N							
	L							5
BOWFIN	N							
	L							54
PERCH	N	1	1		2	6		
	L	8	4		6	8		103
SCULPIN	N							
	L							927
SMELT	N							
	L							68
RAINBOW TROUT	N							
	L							11
SUCKER	N		1					
	L		10					45
CHUB	N							
	L							2
CHANNEL CATFISH	N							
	L							1
CHINOOK SALMON	N							
	L							1
CISCO	N							
TOTALS		202	52	20	37	21	8	2,220

TABLE II-E-3 PALISADES PLANT
Total Number and Weight of Fish Collected from the Traveling Screens
May 16 to May 19, 1972

Species	Total Number	Total Weight (lbs)	Size Range (ins)
Alewife	98	8	2 - 8
Coho salmon			
Lake trout			
Brown trout			
Bloater			
Smelt	8	1/4	2 - 6
Carp			
Spottail shiner	29	1	2 - 6
White sucker			
Longnose sucker			
Channel catfish	2	1/4	6
Black bullhead	6	1/2	2 - 6
Trout-perch	23	1	2 - 6
Burbot	1	2	21
Nine-spine stickleback	22	1/4	2 - 3
Slimy sculpin	948	13	2 - 4
Rock bass			
Bluegill			
Perch	3	3/4	6 - 11
Johnny darter			
Totals	1,140	26 1/2	

TABLE II-B-3 (CONTD) PALISADES PLANT
Total Number and Weight of Fish llected from the Traveling Screens
May 20 to y 26, 1972

Species	Total Number	Total Weight (lbs)	Size Range (ins)
Alewife	172	14	2 - 10
Coho salmon	1		6
Lake trout			
Brown trout			
Bloater			
Smelt	7	1/4	2 - 6
Carp			
Spottail shiner	21	3/4	2 - 6
White sucker			
Longnose sucker	8	16-1/2	12 - 24
Channel catfish	1		6
Black bullhead			
Trout-perch	20	3/4	2 - 6
Burbot	1	1-3/4	16
Nine-spine stickleback	19	1/4	2 - 3
Slimy sculpin	918	13	2 - 4
Rock bass			
Bluegill			
Perch	20	5-1/2	6 - 11
Johnny darter			
Totals	1,188	52-3/4	

TABLE II-E-3 (CONTD) PALISADES PLANT

Total Number and Weight of Fish llected from the Traveling Screens
May 27 to une 2, 1972

Species	Total Number	Total Weight (lbs)	Size Range (ins)
Alewife	606	48-1/2	2 - 8
Coho salmon	4	2-3/4	6 - 19
Lake trout	8	3/4	4 - 6
Brown trout			
Bloater	1	1/4	8
Smelt	61	2-1/2	2 - 10
Carp			
Spottail shiner	882	35	2 - 6
White sucker			
Longnose sucker	3	3	12 - 16
Channel catfish	1		5
Black bullhead	2		2 - 4
Trout-perch	93	4	2 - 6
Burbot	1	1 1/2	19
Nine-spine stickleback	48	1/2	2 - 3
Slimy sculpin	2,506	35	2 - 4
Rock bass			
Bluegill			
Perch	221	51	4 - 13
Johnny darter	2		
Totals	4,439	184-3/4	

TABLE II-E-3 (CONTD) PALISADES PLANT
Total Number and Weight of Fish Collected from the Traveling Screens
June 3 to June 9, 1972

Species	Total Number	Total Weight (lbs)	Size Range (ins)
Alewife	1,400	112	2 - 10
Coho salmon			
Lake trout			
Brown trout			
Bloater			
Smelt	7	1/4	2 - 10
Carp			
Spottail shiner	141	5-1/2	2 - 6
White sucker			
Longnose sucker	3	3	8 - 16
Channel catfish	1		5
Black bullhead	1		3
Trout-perch	28	1	2 - 6
Burbot	4	2-1/2	15 - 17
Nine-spine stickleback	17	1/4	1 - 3
Slimy sculpin	895	12-1/2	2 - 4
Rock bass			
Bluegill			
Perch	1,302	326	4 - 15
Johnny darter	3		
Totals	3,802	463	

TABLE II-E-3 (CONTD) PALISADES PLANT

Total Number and Weight of Fish Collected from the Traveling Screens
June 10 to June 16, 1972

Species	Total Number	Total Weight (lbs)	Size Range (ins)
Alewife	5,365	429	**2 - 8**
Coho salmon	3	1	**6 - 12**
Lake trout	3	1-1/2	**6 - 16**
Brown trout			
Bloater	43	6	**6 - 10**
Smelt	179	7	**2 - 8**
Carp			
Spottail shiner	429	17	**2 - 6**
White sucker	2	3	**11 - 20**
Longnose sucker	13	14	**8 - 20**
Channel catfish	4	1/2	**4 - 6**
Black bullhead			
Trout-perch	158	6	**2 - 6**
Burbot	9	9-1/2	**9 - 20**
Nine-spine stickleback	47	3/4	**2 - 3**
Slimy sculpin	950	13	**2 - 4**
Rock bass			
Bluegill			
Perch	670	168	**2 - 16**
Johnny darter	5		
Totals	7,880	676-1/4	

TABLE II-E-3 (CONTD) PALISADES PLANT

Total Number and Weight of Fish Collected from the Traveling Screens
June 17 to June 23, 1972

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Species	Total Number	Total Weight (lbs)	Size Range (ins)
Alewife	3,537	283	2 - 10
Coho salmon	2		2 - 6
Lake trout	1		6
Brown trout			
Bloater	93	13	4 - 10
Smelt	238	8	2 - 10
Carp			
Spottail shiner	1,728	691	2 - 6
White sucker	1	1	13
Longnose sucker	13	14	8 - 20
Channel catfish	1		6
Black bullhead	15	1	2 - 4
Trout-perch	137	5-1/2	2 - 6
Burbot	5	5	10 - 20
Nine-spine stickleback	62	1/2	2 - 3
Slimy sculpin	551	7-3/4	2 - 4
Rock bass			
Bluegill	1		3
Perch	2,139	494	2 - 16
Johnny darter			
Totals	8,524	1,523-3/4	

TABLE II-E-3 (CONTD) PALISADES PLANT
Total Number and Weight of Fish C cted from the Traveling Screens
June 24 to June 30, 1972

Species	Total Number	Total Weight (lbs)	Size Range (ins)
Alewife	1,904	152	2 - 8
Coho salmon	1		6
Lake trout	1		6
Brown trout			
Bloater	60	8-1/2	4 - 9
Smelt	30	3/4	2 - 8
Carp			
Spottail shiner	725	28-1/2	2 - 6
White sucker	2	1-1/2	10 - 14
Longnose sucker	11	7-1/2	8 - 18
Channel catfish	1	1/4	6
Black bullhead	1		3
Trout-perch	84	3-1/2	2 - 6
Burbot	5	6	12 - 20
Nine-spine stickleback	16	1/8	2 - 3
Slimy sculpin	410	5-3/4	2 - 4
Rock bass	1	1/2	7
Bluegill			
Perch	1,907	387	2 - 14
Johnny darter			
Totals	5,159	601-3/4	

TABLE II-E-3 (CONTD) PALISADES PLANT
Total Number and Weight of Fish Collected from the Traveling Screens
May 16 to July 1, 1972

Species	Total Number	Total Weight (lbs)	Size Range (ins)
Alewife	13,082	1,056	2 - 10
Coho salmon	11	3	6 - 19
Lake trout	13	2	6 - 16
Brown trout	0	0	
Bloater	197	28	4 - 9
Smelt	530	18	2 - 10
Carp	0	0	
Spottail shiner	3,955	158	2 - 6
Longnose dace	3		
White sucker	5	6	8 - 16
Longnose sucker	64	60	8 - 20
Channel catfish	11	2	4 - 6
Black bullhead	25	1	3 - 4
Trout-perch	543	22	2 - 6
Burbot	26	29	12 - 24
Nine-spine stickleback	231	3	1 - 3
Slimy sculpin	7,178	101	1 - 4
Rock bass	1	1/2	7
Bluegill	1		2
Perch	6,262	1,476	2 - 16
Johnny darter	10	1/8	1 - 2
Totals	32,148	2,965-3/4	

The alewife, smelt, spottail shiners, trout-perch, slimy sculpin and perch are thus far the most frequently observed species collected from the screens. Pertinent observations for several species as they pertain to the period after May 16, are summarized below:

Alewife: This species occurs often when the screens are washed. They have become quite numerous since the beginning of June reaching a maximum number of over 5000 the week of June 10 - 16. Most of the specimens are adults, with only an occasional yearling being recorded.

Smelt: This species occurs occasionally when the screens are washed. The maximum number collected at one time occurred on a day of exceptionally high wind and rough wave action. Over 200 specimens totaling almost 7 pounds were collected on June 23, which accounts for almost 40% of the total number of smelt collected.

Spottail Shiner: This species has appeared regularly. In early June, 5 - 10% of the specimens were ripe females and expelled eggs were found in the collection basket.

Trout-perch: This species is found in many collections, but usually in low numbers. The most specimens recorded occurred during the weeks of June 10 through June 23.

Slimy Sculpin: This species also occurs frequently, and was collected in large numbers (900-2500 per-week) during mid and late May, but has been recorded in much lower numbers during June. Ripe females were noted, but at less than 4-5% of the total numbers observed. Several expelled egg masses were from the sculpins.

Perch: Few perch were recorded in May, but the numbers increased during June and maintained an average of about 1500 per week during the month. Ripe females were observed and made up less than 10% of the total numbers recorded.

Lake Trout: Only 13 lake trout have been recorded. All were marked with a right pelvic fin clip, and except for one 16-inch specimen, all were 6 inches or less in length. These specimens were collected from late May through June, but 60% were collected in the week of May 27 to June 2.

Coho: Eleven Cohos have been recorded thus far. These were all 6 inches or less, except for a single 12-inch specimen. This species, like the lake trout, has appeared infrequently in the screen washings.

Bloater: This species began to appear in the collections the last three weeks in June. They appear sporadically and are usually recorded in numbers in one washing and not at all in others.

There seems to be an increase of most species entrained during periods of high wind and wave action. The largest single collection ocurred on June 23 when over 150 pounds of fish were recorded in a 6 hour period.

Fish Sampling in Lake Michigan By Others

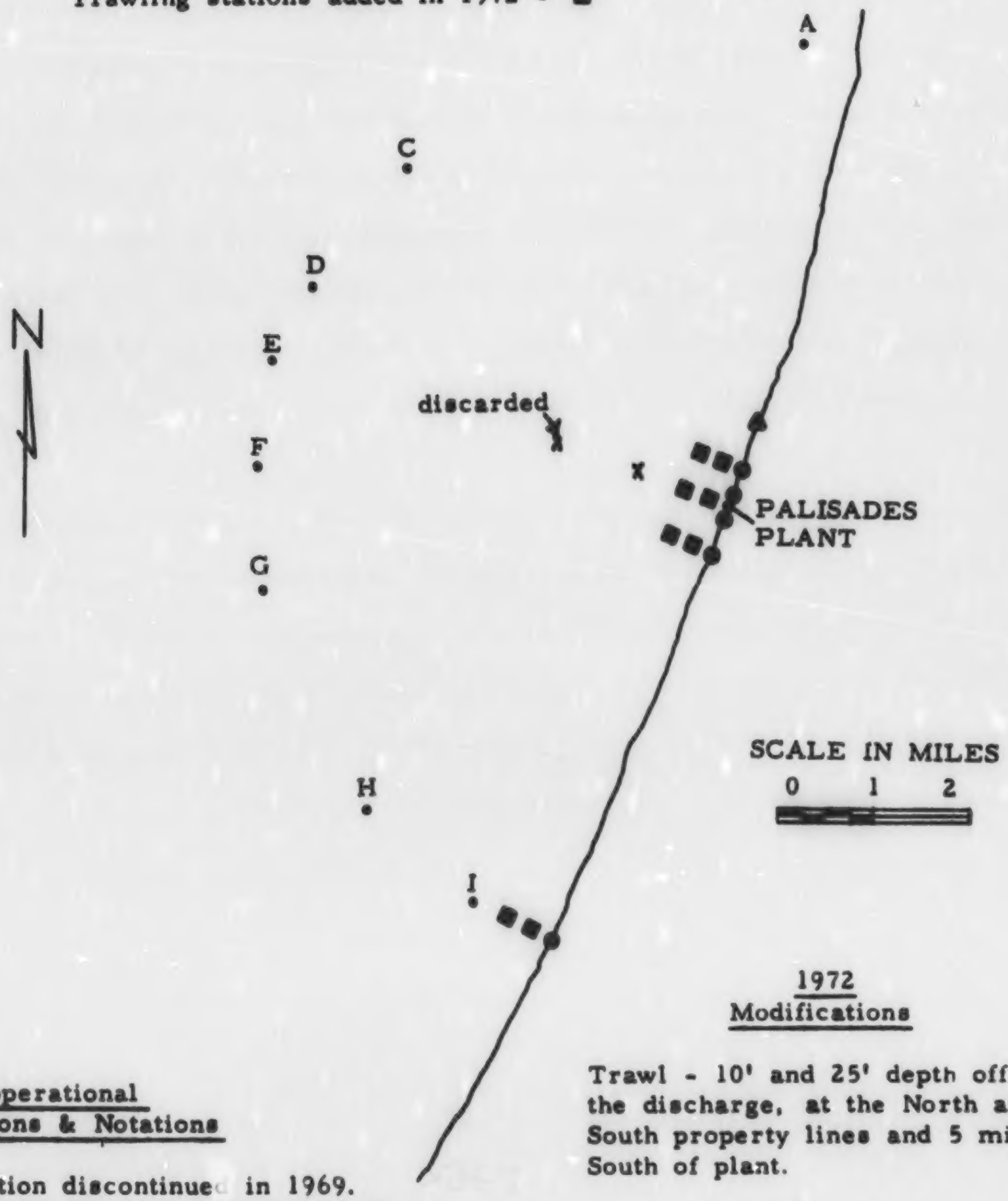
Preoperational fish sampling in the vicinity of the Palisades Plant began in 1969 when the Michigan Department of Natural Resources began participation in the cooperative environmental study progam. Their work has consisted primarily of selective placing of gill nets and seining a portion of beach north of the plant property. Details of the DNR fish collections through 1970 were given in a report submitted as Appendix C of the Applicant's "Supplemental Information on Environmental Impact of Palisades Nuclear Plant". The station locations for this program are shown on Exhibit II-E-1, as well as those for the Applicant's separate fish collections.

During the period June 12-15, 1972 DNR biologists repeated sampling runs in the same manner that had been done during the preoperational surveys. They also did additional comparative gill netting within and out of the influence of the thermal plume. The following section reports the results of these collections as well as providing interpretative comparisons with all of the preoperational collections.

PALISADES PLANT
FISH COLLECTION STATIONS

Preoperational	Gill Nets	x	(2-24 hr periods up to 4 times/year)
	Seining	▲	day and night up to 4 times/year

Seining stations added in 1972 - ●
Trawling stations added in 1972 - ■



Preoperational Modifications & Notations

60' Gill Net Station discontinued in 1969. Trawling data from Bureau of Commercial Fisheries for 24' and 42' on May 3 1969 and 18' 42' and 72' on July 25 1969.

Also Gill Net data From Bureau of Sport Fisheries and Wildlife for 18' and 30' on November 16, 1971 and December 3, 1971.

1972 Modifications

Trawl - 10' and 25' depth off the discharge, at the North and South property lines and 5 miles South of plant.

Seine - Directly adjacent to discharge in direction of the plume at the North and South property lines and 5 miles South of plant.

Fish sampling at the Palisades power plant site in June 1972

M. H. Patriarche

To start the fifth consecutive year of fish population sampling in Lake Michigan at the Palisades power plant site in Van Buren County, gill netting and seining were done during the week of June 12-15 by DNR biologists (June 14-16 in 1971). The plant was operating at 60% of full capacity and had been doing so for approximately 10 days. Prevailing light southerly winds kept the plume along the shore north of the plant during the time we were sampling. A previously scheduled May sampling period was cancelled both because the research boat used in the past was disabled and the plant was shut down for repairs for an extended period.

The four 250-foot nylon gill nets purchased last year were used. Mesh sizes ranged from 1 1/2 inches to 4 inches (stretched mesh) and the nets were set at four sites parallel to the shoreline on the 12th, raised the following morning, re-set at four different sites that evening, and again lifted on the morning of the 14th. Surface temperatures were taken to ensure that fishing was done within and without the plume and a maximum-minimum thermometer was attached to the float line of each net. On the 12th two nets were set in 15-22 feet of water, one of which was in the plume. The other pair were set in 40 feet of water outside the plume. On the 13th all nets were confined to water depths of less than 27 feet, one pair lying parallel to shore and one pair set perpendicular to shore. Furthermore, one of each of the above was set in the plume. Water temperatures for each set are listed in Table 1.

Shoreline seining was done along the beach at Van Buren State Park on the night of June 13 and again on the morning of the 15th. Four seine hauls were made along 550 feet of beach using the same gear and technique as previously except that the hauls were somewhat shorter than last year because the end of the seining area was mis-identified in the dark. The seine was a 125-foot bag seine with 1/4-inch bar mesh in the bag; 3/4-inch elsewhere. Most fish collected at night were preserved for later identification and enumeration.

Gill net catches for the month of June in 1971 and 1972 are shown in Table 2. Only the 1971 catches by the new gill nets are compared with those in 1972, and the data are presented as number per 100 feet net because the amount of net fished varied. Included in the table are depths, surface temperatures when set, dates, and the amount of netting. Of immediate interest, of course, are the catches in and out of the plume in water under 27 feet. The total catch in the plume was 69% greater than outside for the shallower sets. Most of this increase was due to alewives, large concentrations of which also were seen congregated around the outlet. Many carp were seen there too, but this fish is notoriously shy of gill nets and none were captured. Also caught in somewhat larger numbers were perch, suckers, and the deepwater chub (C. hoyi). In 1971 the surface temperature was almost the same (64°) at the time of the June sampling and even larger catches of alewives and perch were made. Hence no real significance can be attached to the results of this first sampling period with respect to the plume effect. Catches in 40 feet of water were much smaller in both years than in the shallower sets. The 1972 perch catch, however, was identical at both depths outside the plume. The total catches in the parallel and perpendicular sets were the same, with minor differences among the various species.

The seining results for not only 1972 but also those for June in prior years are presented in Table 3. As usual, nighttime catches were much greater than those during the day. In general the species were caught in the same order of magnitude as in previous night catches with spottail shiners more abundant than previously. No perch were captured this year but only once were any number ever caught and that was during the day seining last year. Included among the salmonids were brown trout fingerlings (16) for the first time, chinook, and rainbows. A total of 23 salmonid fingerlings were caught in the morning; 14 at night. Last June large amounts of filamentous algae coated the seine on each drag but no algae problems were experienced this year. Water temperatures were, on the whole, little different this year than in previous years. In fact, the plume was presumably inshore but the night water temperature was 5° cooler than last year. Daytime temperatures were identical this year and last (69°). The beach at the state park is perhaps 1/2-3/4 mile north of the plant.

The next sampling period is expected to be the week of August 14-18, at which time we hope to have the regular boat back in operation and attempts will be made to also trawl in and out of the plume. The substituted Thunderbird used in June was not suitable for that type of operation.

Table 1. --Water temperatures at various 1972 netting sites

Set No.	Depth (feet)	Temperatures (°F) *		
		Setting	Lifting	Minimum
June 12				
1	15	54	55	53
2**	15-22	65	60	55
3	40	53	55	52
4	40	53	52	48
June 13				
1**	18	64	59	58
2**	10-20	67	59	54
3	20	60	56	52
4	26	60	59	56

* Setting = surface temperature when nets were set
Lifting and minimum = temperature at float line depth.

** Plume set.

Table 2.--Number of fish per 100 feet of graded-mesh gill nets set in front of the Palisades power plant in June 1971 and 1972

	1971	1972		1971	1972
		Control	Plume		
Depth (feet)	20	15-26	10-22	40	40
Surface temperature (°F)	64	53-60	64-67	64	53
Dates (June)	14-16	12-14	12-14	14-16	12-14
Feet of net	500	750	750	500	500
Species:					
Alewife	96.2	21.3	38.9	3.2	11.2
Perch	15.2	10.1	13.2	25.0	10.0
Longnose sucker	0.8	1.2	3.9	-	1.2
Spottail shiner	0.4	2.5	2.3	-	1.2
Bloater	-	0.1	1.5	-	1.4
White sucker	0.6	0.3	1.1	-	0.1
Coho	-	0.5	0.3	0.6	-
Lake trout	-	-	-	-	0.8
Brown trout	-	0.1	-	-	-
Burbot	-	0.1	-	-	-
Total catch	566	270	458	144	130
Number per 100 feet net	113.2	36.0	61.1	28.8	26.0

Table 3. --Number of fish per 100 feet of beach seined both day and night at Van Buren State Park in June, 1969-1972*

	Day				Night		
	1969	1970	1971	1972	1970	1971	1972
Date (June)	25	16	16	15	22	16	13
Water temperature (°F)	56	65	69	69	67	69	64
Feet seined	1200	900	1000	550	900	1000	550
Species:							
Spottail shiner	19.3	0.9	40.7	36.7	91.0	43.6	106.2
Longnose dace	3.8	12.7	3.7	5.3	11.7	10.2	16.0
Salmonids	0.4	0.7	0.5	4.2	-	0.2	2.5
Alewife (3 inches)	0.3	-	12.9	0.9	0.2	(1)	0.5
Alewife (adult)	(1)	-	-	-	43.9	0.9	33.5
Trout-perch	-	(1)	-	-	8.4	4.1	(1)
Perch (2-3 inches)	-	-	5.6	-	0.4	0.7	-
Total catch	297	132	636	267	1,407	616	879

* One fish is indicated by (1). Some species of numerical insignificance have been omitted.

In Appendix C of the Applicant's "Supplemental Information on Environmental Impact of Palisades Nuclear Plant" data were also included of fish collections in the vicinity of the Palisades site made by the Bureau of Sport Fisheries and Wildlife, R/V Cisco. Additional data have been supplied which include late 1971 as well as some collections during plant operation in 1972, as shown in Tables II-E-4-7. In addition, to the data shown, it was reported that on Cruise V (June 6-22) tows with a 1/2 meter net of 351-micron mesh at various midlevels over bottom depths of 3 and 5 fathoms resulted in collections of perch and alewife fry.

TABLE II-E-4
PALISADES PLANT

Numbers of lake trout and whitefish in various large-mesh (5, 5-1/2 inch, stretched) gill net lifts, Cruise XII

Date	Depth (Fathoms)	Length of net (feet)	Lake trout					Whitefish
			Male	Female grand	Female ripe	Female spent	Total	
11/16/71	3	600	17	1	5	0	23	0
11/16/71	5	600	9	0	2	0	11	0
12/ 3/71	3	1,200	1	0	0	1	2	0
12/ 3/71	5	1,200	2	0	0	0	2	0

TABLE II-E-5
PALISADES PLANT

Numbers of fish caught in standard salmon gill net set (300 feet each of 3-1/2, 4, 4-1/2 and 5 inch mesh on bottom at 3 fathoms)* Cruise II, April 4-20, 1972

Species	Number	
Coho	95	(average weight 1.9 lbs)
Chinook	1	
Lake trout	4	
Whitefish	1	
Suckers	3	
Yellow Perch	1	
Northern Pike	1	

*Based on fin clips, twelve of the cohos had been stocked in Platte River, Michigan and two in Indiana; the others were unclipped.

TABLE II-E-6
PALISADES PLANT

Catches per 10-minute tow with a 39-foot trawl, Cruise II, April 18, 1972

Species[1]	Number at 25 fathoms	Number at 30 fathoms
Alewife (adult)	466	161
Alewife (young)	-	3
Bloater (adult)	45	45
Bloater (young)	2	1
Lake trout	16	1
Sculpin, slimy	27	10
Smelt (adult)	41	56
Smelt (young)	7	-
Spottail shiner	6	-
Stickleback, ninespine	3	-
Trout-perch	6	17
Lake herring	1	-

---

[1] Young refers to yearlings in collections made before August 1, and young-of-year after August 1.

TABLE II-E-7
PALISADES PLANT

Numbers of fish caught in gill net overnight (50 feet each 1-1/4 and 1-1/2 inch, 100 feet 2-inch, and 600 feet each 3-1/2 and 4-inch mesh, set with float lines 3 feet below surface over bottom depth of 9 fathoms) Cruise III, May 5, 1972

Species	Number
Coho	8
Lake trout	17
Alewives	630
Smelt	7
Longnose sucker	1
Black bullhead	1

Additional Seine Collections

All seine collections thus far have been made using a 125-foot nylon bag seine. Because of the selectivity of this seine, supplementary collections will be made as a part of the Applicant's study program using a 40-foot, 1/8-inch mesh minnow seine. It is felt that use of both seines will give a more accurate sample of the fish at the various stations, especially the young-of-the-year which may be in this area.

The 125-foot bag seine is pulled parallel to the shore for a distance of 300 feet and then pulled into shore. Two 300-foot sections are seined at each station if weather and time permits, giving usually a sampling area approximately 1500 feet in length along the shore in the plant area.

Tables II-E-8-11 show the results of two daytime and two nighttime seining collections. Changing weather conditions enabled only the control and heated north discharge stations to be seined on June 13. Usually only one discharge section is seined per collecting trip depending on the direction of the thermal plume. The north boundary station was not seined on June 15 due to comparable collecting in that area (Van Buren State Park) by the Department of Natural Resources personnel.

In three of the collections, when a thermal discharge was present, many more alewife, carp and spottail shiners were captured in the heated water than in the stations not affected by the discharge. This agrees with visual observations in the discharge canal where these three species of fish are very numerous at all times when heated water is being discharged.

The salmonids have been collected at all stations except where the water is heated by the discharge, indicating they may avoid this area. The heated discharge does seem to be an attractant to alewife, carp and spottail shiners as evidenced by their absence when the plant shuts down and no heated water is discharged. The only lake trout collected by seining was captured on May 23 just north of the discharge structure when no thermal discharge was present.

On June 13 and June 15 carp were marked in the discharge with yellow plastic streamers in the dorsal fins. The purpose was to establish rough population estimates and to determine if the carp were remaining in the discharge. One hundred carp were marked and visual observations were made on subsequent days. Marked carp were observed for two weeks after the marking, but the plant then shut down and no marked carp were observed up to July 1. Rough population estimates based on established mark and recapture methods showed between 1,000 to 3,000 carp were in the area of the discharge on any one day in late June, while the heated discharge was present. It is thought this may be a low estimate, because at times hundreds of carp were seen and none were marked. The discharge also has an abundance of alewives as evidenced by seine and trawl hauls in this area when heated water is present. It is impossible to estimate how many alewives were in the discharge, but 100,000 would be a conservative estimate for the late June period. Nowhere else in the immediate area do carp or alewife numbers approach those in the discharge.

TABLE II-E-8
PALISADES PLANT

Fish captured by use of 125-foot bag seine May 16, 1972 at night

	Station				
Species	Control	North Boundary	South Boundary	North of Discharge	[1]South of Discharge
Alewife (Adult)	2	0	0	1	500[2]
Coho[3]	0	2	3	5	0
Smelt	0	0	1	0	24
Spottail shiner	0	1	2	25	20
Pumpkinseed Sunfish	0	0	0	0	1
Temperature(°F)	51	50	51	51	58

(1) Thermal plume extended south and warmed seining area 7°F above ambient of 51°F.
(2) Estimated to be at least this many fish.
(3) Three to six inches in length.

TABLE II-E-9
PALISADES PLANT

Fish captured by use of 125-foot bag seine May 23, 1972 during day

	Station				
Species	Control	North Boundary	South Boundary	[1]North of Discharge	South of Discharge
Alewife (Adult)	26	24	95	35	26
Coho[2]	1	1	162	5	1
Lake Trout	0	0	0	1	0
Smelt	0	1[3]	0	0	0
Spottail Shiner	128	56	4	47	1
Temperature(°F)	50	51	51	51	51

(1) No thermal discharge, plant not operating but circulating water pumps working.
(2) Three to six inches long.
(3) Right pelvic fin clipped, 6 inches in length.

TABLE II-E-10
PALISADES PLANT

Fish captured by use of 125-foot bag seine June 13, 1972 at night (NS - not seined)

	Station				
Species	Control	North Boundary	South Boundary	[1]North of Discharge	South of Discharge
Alewife (Adult)	80	NS	NS	2,000[2]	NS
Coho	4			0	
Smelt	1			0	
Carp				40	
Spottail Shiner	9			2	
Temperature(°F)	62			67	

(1) Thermal plume extended north and warmed seining area 5°F above ambient of 62°F.
(2) Estimated to be at least this many fish.

TABLE II-E-11
PALISADES PLANT

Fish captured by use of 125-foot bag seine June 15, 1972 during the day (NS - not seined)

	Station				
Species	Control	North Boundary	South Boundary	[1]North of Discharge	South of Discharge
Alewife (Adults)	20	NS	40	1,200[3]	NS
Alewife (3 inches)	98		4	0	
Coho	16				
Brown Trout[2]	6		4	0	
Carp	1		4	78	
Spottail Shiner	135		48	207	
White Sucker	0		1	0	
Nine-spine Stickleback	1		0	0	
Bluegill	3		0	2	
Perch	0		0	6	
Temperature (°F)	67		69	74-77	

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(1) Thermal plume extended north and warmed seining area 7°F to 10°F above ambient of 67°F.
(2) Right pectoral fin clipped (3-6 inches in length).
(3) Estimated to be at least this many fish.

Additional Fish Trawling

Two trawl collections have been made at each station (Exhibit II-E-1) at 10 and 25 foot depths. A 25-foot trawl is utilized and 5-minute hauls are made on the bottom at each station. Results of these trawl hauls on May 24 and June 13 are shown in Table II-E-12. Also, Table II-E-13 shows the results of 5-minute trawl tows on June 13 starting at the shore area of each station and towing out into the lake from approximately a 3-foot depth to a 25-foot depth. This type tow was tried twice at each station and the data combined.

The tows of May 24 were done in the absence of a heated discharge when the plant was not in operation. Few specimens were collected at any of the stations and the only conclusion that could be reached is that fish were not inhabiting the 10 to 25-foot depths at this time.

The tows of June 13 were done in the presence of a thermal plume which varied in temperature at the surface from 12°F above ambient of 57 °F at the point of discharge to 3°F above ambient lake at the 25-foot depth. The thickness of the surface plume was only 1-2 feet at the 25-foot location and more than 5 ft deep at the 10-ft depth near the discharge. From the data, it can be seen that very few fish were captured at the 25-foot depth (only at the North boundary station), but at the 10-foot depth more alewives and smelt were captured in the discharge area than at any other station. The alewives were also usually observed in greater numbers in the discharge area. The smelt were not visually observed in the discharge area, but more were collected in the discharge area than at any other station. Both adult and young smelt were collected at each 10-foot depth station with no increase of either group recorded at any one station.

Additional Fish Trawling (Contd)

A very general conclusion from the trawling data would be that alewives, and perhaps smelt, were more numerous in the area of the discharge and the plume. Alewives, along with carp and spottail shiners, were found to be more numerous in the area of the discharge and the plume in the seining collections.

TABLE II-E-12
PALISADES PLANT
FISH TRAWLING DATA, MAY 24 AND JUNE 13

Catches per 5-minute tow with a 25-foot trawl, May 24, 1972

Location

Species	South Boundary Depth (ft) 10	 25	*Discharge Depth (ft) 10	 25	North Boundary Depth (ft) 10	 25	Control Depth (ft) 10	 25
Alewife	1	5	0	2	0	0	4	1
Smelt	0	0	0	2	0	0	0	0
Spottail shiner	0	0	0	0	1	0	0	0
Johnny darter	0	0	0	1	0	0	0	0

*No heated water in discharge, plant not operating - current to north.

Catches per 5-minute tow with a 25-foot trawl, June 13, 1972

Location

Species	South Boundary Depth (ft) 10	 25	Discharge Depth (ft) 10	 25	North Boundary Depth (ft) 10	 25	Control Depth (ft) 10	 25
Alewife	24	0	762	0	135	35	8	0
Smelt	5	0	40	0	10	0	17	0
Spottail shiner	9	0	5	0	2	0	0	0
Perch	2	0	0	0	2	0	0	0

TABLE II-E-12 (Contd)
PALISADES PLANT
Temperature Data During Trawls (°F)

May 24, 1972

South Boundary			Discharge*			Control			North Boundary		
10'	Depth (ft)	25'	10'	Depth (ft)	25'	10'	Depth (ft)	25'	10'	Depth (ft)	25'
56.1	Sur	49.9	45.5	Sur	49.4	57.8	Sur	50.4	58.2	Sur	51.2
50.2	5	46.8	46.1	5	47.1	48.8	5	46.3	49.1	5	47.1
45.5	10	45.4	45.9	10	45.2	46	10	45.7	46.4	10	46.2
	15	45.8		15	45.0		15	44.8		15	45.3
	20	44.1		20	43.9		20	44.4		20	43.8
	25	43.6		25	44.0		25	43.9		25	43.9

June 13, 1972

South Boundary			Discharge			Control			North Boundary		
10'	Depth (ft)	25'	10'	Depth (ft)	25'	10'	Depth (ft)	25'	10'	Depth (ft)	25'
60.6	Sur	60.2	69	Sur	61.5	63.2	Sur	61.2	63.3	Sur	62
58.8	5	58.4	64.6	5	61.0	60.0	5	58.9	61.4	5	53.7
57.5	10	57.8	59.4	10	57.6	59.7	10	58.2	58.7	10	52.5
	15	57.6		15	56.3		15	57.2		15	52.2
	20	57.6		20	56.4		20	57.0		20	51.5
	25	57.5		25	56		25	57.2		25	51.2

*No heated water in discharge, plant not operating - current to north.

TABLE II-E-13
PALISADES PLANT

Catches per 5-minute tows pulled perpendicular to shore with a 25-foot trawl June 13, 1972. (Total number of fish from two 5-minute tows combined.)

	Location			
Species	South Boundary	Discharge	North Boundary	Control
Alewife	86	600	170	54
Smelt	6	0	10	12
Spottail shiner	0	7	2	2
Perch	0	0	2	0

Fish Eggs and Larva

The likelihood of fish eggs and larva being drawn into the intake structure and passing through the plant has been studied and the results of 142 hours of sampling are presented in Table II-E-14. The method employed in sampling the intake water is to suspended a #20 mesh Wisconsin plankton net in the intake bay on an anchored line so the mouth of the net faces the incoming water. The net remains oriented in this position, although occasional currents move it in a lateral direction. The amount of water passing through the net is calculated assuming a constant current of 9 feet/second through the 5-inch diameter opening of the net. Attempts to measure true velocity conditions in the intake bay produced highly erratic results because of turbulent conditions. The value selected is the theoretical average velocity through the intake pipe and probably represents a maximum condition at the sampling point.

TABLE II-E-14
PALISADES PLANT
Number of Fish Eggs and Larvae Collected from the Intake
May 16 to June 30, 1972

Date	Collection Time (Hours)	Approx. Amount of Water Sampled (Gallons)	Number of Eggs	Number of Larvae
May 17	3	194,400	1	0
May 18	1	64,800	0	0
May 24	3	194,400	2	0
June 6	7	453,600	4	0
June 8	7	453,600	7	4
June 14	9	583,200	0	0
June 15	21	1,360,800	826	0
June 16	19	1,231,200	10	0
June 20	24	1,555,200	5	0
June 21	24	1,555,200	58	0
June 22	24	1,555,200	5	0
TOTAL	142	9,201,500	918	4

A total of 9,201,500 gallons of water is estimated to have been sampled in 142 hours, producing a total of 918 eggs and 4 larva in the samples. One sample, the June 15 one, contained a total of 826 eggs, which comprised 89% of all eggs collected. These eggs were thought to be perch eggs due to the occurrence of ripe perch in the traveling screen collections during this time period. It is possible that ripe female fish may be expelling their eggs in the intake pipe rather than the eggs being pulled into the intake from the area around the intake openings. The four larva have not been identified, but seem to represent an insignifcant number passing into the plant at this point in the study. It should be noted that the R/V Cisco cruise in mid-June found perch and alewife fry near the plant at depths of 3 and 5 fathoms, which would be comparable to intake withdrawl level.

Benthic samples are analyzed for the presence of fish eggs to identify spawning and egg incubation areas in the vicinity of the site. The numbers of fish eggs in the preparational benthic samples are tabulated in Appendix F and classified by time of collection and depth zones. A summarization of spawning information on selected fish species is also included. Observations of fish eggs in the June, 1972 benthic samples are included in the initial results reported in Table II-C-1.

In each year, the collections from June usually contained the highest number of eggs at all depth zones and at each time of year. The perch, alewife, and smelt are the principal species known to reproduce in the area at this time of year; thus, they are in all probability the type of fish eggs found in the analyses. This agrees with both the egg collection data from the intake and the fish collecting data. The most eggs collected from the intake were in mid to late June and the ripe fish in the area at this time were generally perch and alewives. Data from analyses of benthic samples in 1972 for fish eggs is not yet available.

information which we have, ask them what further information they need, and then ask them for their educated opinion as to the effect upon the ecosystem.

MR. McDONALD: Are you a lawyer?

MR. PETERSEN: I am a lawyer as I identified myself at the beginning.

MR. McDONALD: Pardon?

MR. PETERSEN: As I identified myself at the beginning of my statement, sir.

MR. McDONALD: I have no further questions.

MR. MAYO: Mr. Purdy.

MR. PURDY: Mr. Petersen, on page 2 of your statement, as it relates to the -- "no evidence of any water masses that could be attributed to the effect of warm water discharges from powerplants into the lake" -- these studies did, in fact, show thermal plumes; they did not show a large heated water mass from that plume moving out into the lake.

MR. PETERSEN: That is correct.

MR. PURDY: Thermal plumes were identified.

MR. PETERSEN: Yes, yes, indeed.

MR. PURDY: The other -- not a question but a comment -- there is a difference, I believe, in the Water Resources Commission feeling and what you have expressed here, with respect to whether the Water Resources Commission in large measure accepted or rejected the recommendations of the Administrator.

It is my feeling that the Water Resources Commission feels that they did, in large measure, accept, not reject the recommendations of the Administrator as it relates to thermal standards for Lake Michigan.

MR. PETERSEN: May I state that that would have been better phrased that 3 of the 4 States made what might be considered significant deviations from the recommendations which were presented by the Federal conferee and adopted by the conference.

MR. MAYO: Just by way of an observation, Mr. Petersen, you at least implied in the third paragraph of your statement that at the last session of the conference the Federal conferee muscled the 4 State conferees into taking a positon, and I would like to make the point very clear: I consider Bill Blaser and Ralph Purdy, Perry Miller and Tom Frangos, as being four of the very, very capable, and four of the tougher water pollution control administrators in the country, and we don't get away with muscling them around.

I think there was a good deal of rationale, and a good deal of concerted technical persuasion that led to the recommendations that came out of the conference, not the application of muscle.

MR. PETERSEN: I thank you for your comment. I am sure that your comment about the quality of the gentlemen is quite accurate; however I do not withdraw mine. (Laughter)

MR. PURDY: Mr. A. Joseph Dowd, American Electric Power.

STATEMENT OF A. JOSEPH DOWD,
ASSOCIATE GENERAL COUNSEL,
AMERICAN ELECTRIC POWER SERVICE CORPORATION,
NEW YORK, NEW YORK

MR. DOWD: Mr. Chairman, conferees, ladies and gentlemen. My name is Joseph Dowd. I am Associate General Counsel of American Electric Power Service Corporation and am appearing here today on behalf of Indiana & Michigan Power Company, which is one of the companies of the American Electric Power System, and which is presently constructing the Donald C. Cook nuclear plant at Bridgman, Michigan, on the shore of Lake Michigan.

My remarks will basically consist of several observations regarding the Federal Environmental Protection Agency's thermal report, which was submitted to this session of the conference.

At page 14 of the EPA report, reference is made to the litigation instituted by the Indiana & Michigan Electric Company against EPA. That reference states that the litigation has been dismissed, but does not reflect the fact that an appeal from that dismissal is presently pending before the Federal Court of Appeals for the District of Columbia. In fact, briefs on appeal by both parties have already been filed, and we expect that oral argument will take place within the next few months.

We would hope that the EPA report could be amended to reflect the pending appeal.

Also, it should be noted that in dismissing the case on what basically were procedural grounds, the lower court judge stated, and I quote: "It appears that the Water Pollution Control Act confers no authority on the Administrator to provide how an electrical generating plant is to be constructed."

The judge went on to say, and I quote: "Even if the Administrator is authorized to require closed-cycle cooling for plaintiff's plant, I have serious doubts with respect to the legality of the procedure followed in this case. The Lake Michigan Enforcement Conference was convened pursuant to Section 10 (d) of the Water Pollution Control Act. That conference has to do only with existing pollution abatement."

Our participation in this conference today should not be construed as being in any way inconsistent with the views expressed by the court.

Having gotten these few preliminaries out of the way, I would like now to address myself to EPA's thermal policy, which appears on pages 17 and 18 of the EPA report.

As stated on page 17, and I quote: "EPA has established the policy that all discharges to the aquatic environment involving waste heat must be evaluated on a case-by-case basis, taking into account that some discharges must be evaluated collectively due to their combined impact on the receiving water."

This "collective evaluation" must presumably relate to those limited situations involving discharges which are in close proximity to each other and which, therefore, present the possibility, the potentiality of overacting or interacting plumes.

This policy would appear to apply to all plants; those presently operating; those under construction, such as our Cook plant; and future plants.

If our understanding of EPA's policy is correct; i.e., if the words mean what they appear to mean, then a case-by-case evaluation of thermal discharges is a sensible and a constructive policy. It is a policy which, if properly administered, will assure necessary environmental protection without the imposition of unnecessary costs on the consumers of electric energy. It is a policy which makes sense, and which should be applied to Lake Michigan as well as to other major bodies of water in the United States.

Also, such a policy would appear to be consistent with the case-by-case approach adopted by the State of Michigan in August of 1971, thereby permitting, we would hope, prompt approval by EPA of the Michigan standards.

Now, the foregoing represents our understanding of the English language as it appears on pages 17 and 18 of the EPA report. However, Mr. Bryson, in his oral presentation this morning, added a concluding statement which does not appear in the EPA written report. If I understand Mr. Bryson correctly -- and I hope that he will correct me if I misrepresent what he said, or the effect of what he said -- Mr. Bryson, in spite of the stated case-by-case approach, said that EPA is adhering to its previous position by a 1,000 foot mixing zone with no more than a 3°F. temperature rise at the edge of that mixing zone for all thermal discharges to Lake Michigan. And that all plants on the lake which were not in operation on March 1, 1977, that such plants be operated with closed cooling systems.

This, of course, is hardly a case-by-case approach. It is, in fact, the very antithesis of a case-by-case approach. Thus, black means white; yes means no; up means down; and case-by-case really means across-the-board — at least for Lake Michigan.

One can only speculate as to why this was not made explicit in EPA's written thermal report to this session of the conference, which report was made available to the public several weeks ago.

Let me ask a few questions which are not entirely rhetorical.

Why has EPA's thermal policy, which was enunciated in Mr. Quarles' letter of May 12, 1972, and in his speech of May 16, 1972, been completely ignored insofar as Lake Michigan is concerned?

If a case-by-case approach is appropriate for the rest of the United States, why is it not also appropriate for Lake Michigan? After all, the first thermal finding, which was set forth in the summary of the last session of this conference, stated that, and I quote: "The lake as a whole will not be warmed except in localized areas by the discharges of waste heat from existing and presently proposed powerplants." This is a finding which, I believe, was concurred in by EPA, and which dictates a case-by-case evaluation for Lake Michigan.

In March of 1971, the Third Session of this conference was called by EPA for the express purpose of considering the recommendations of a Technical Committee on thermal discharges. The conference was held and the Technical Committee's recommendations were almost totally ignored.

Today we are attending the Fourth Session of this conference. EPA stated in its written report, which was publicized in advance of this session, that its thermal policy involved a case-by-case approach.

On the basis of EPA's performance this morning, it now appears that the publicized case-by-case approach will be ignored in favor of the old and discredited across-the-board approach.

We respectfully submit that this type of behavior is most unbecoming and most inappropriate for a responsible Federal agency.

Before closing, I would like to make brief mention of the ecological studies of Lake Michigan which would have relevance to the thermal question and to which the AEP System either alone or in conjunction with other Lake Michigan utilities is responsible. These are studies which have gone forward since the conclusion of the conference workshop almost 2 years ago.

A. Dowd

First are the series of limnological studies, Volumes 6, 7, 8, 9, and 10 of which have been completed and published since the conference workshop. These studies relate to the immediate vicinity of the Cook plant as well as to the effects of thermal discharges from existing Lake Michigan powerplants.

They are funded by I & M and are being carried out by the Great Lakes Research Division of the University of Michigan under the direction of Dr. John C. Ayers. All of the volumes of this study have been furnished to the conferees, including EPA, as they have been completed.

I would like to point out for the benefit of Mrs. Voita, and to set the record straight, that these studies do include studies of the effects which thermal discharges from the Cook plant will have upon winter ice packs up along the shore. These studies conclude that there will be no appreciable effect.

As you may recall, during the conference workshop in 1970, we presented testimony and exhibits relating to an aerial survey which was being carried out for I & M by the Willow Run Laboratories of the University of Michigan. This work has continued since that time under the joint sponsorship of I & M, Consumers Power Company and Northern Indiana Public Service Company.

Mr. Petersen has entered into the record as an exhibit a report containing black and white photographs. We have what I believe is the same report, but it contains the colored photographs, and we would like to offer this, Mr. Mayo, as an exhibit for the record.

MR. MAYO: It will be received.

(The document above referred to is on file at U.S. EPA Headquarters, Washington, D.C., and Region V Office, Chicago, Illinois.)

MR. DOWD: In addition, I & M in 1970 commenced a study of lake water temperatures in the general and immediate vicinity of the Cook plant site. Daily maximum values at the Benton Harbor and the St. Joseph city water intakes have been obtained. Also thermistor sensors on armored submarine cable were installed at the Cook plant site and have been used to record temperatures at five different points in the immediate vicinity of the site.

Despite a number of problems caused by the winter ice packs, lightning, sand movement, and even human sabotage, we have been able to obtain a substantial amount of data on lake water temperatures. This raw data has been made available to the conferees in Volumes 7 and 10 of the limnological studies.

The work completed since the 1970 conference workshop shows no significant adverse effects to the lake resulting from powerplant thermal discharges. This work also emphasizes the dynamic and variable character of the lake. For example, that huge amounts of cold water exist which are stirred about and occasionally come to the surface even during the hottest months, and that the distributions of fishes, phytoplankton, and zooplankton in the lake are very irregular, occurring in nonuniform concentrations and patches, all of which tends to confirm the appropriateness of evaluating thermal discharges to Lake Michigan on a case-by-case basis.

Mr. Chairman, this concludes our statement.

MR. MAYO: Any comments, gentlemen?

MR. PURDY: I have a question, Mr. Chairman.

MR. MAYO: Mr. Purdy.

MR. PURDY: Mr. Dowd, earlier Mr. Falls reported his determination that certain scouring problems would occur at the outfall structure. I am wondering if your modeling studies have identified this, and if so have adjustments or have remedial measures been incorporated into your project?

MR. DOWD: The answer to both questions is yes, Mr. Purdy.

Our modeling studies recognize the distance of scour, and we have taken measures to rip-rap to the extent necessary to take care of any scouring problem that might occur.

MR. PURDY: That is all.

MR. MAYO: Any other comments, gentlemen?

MR. McDONALD: I would like to make a comment, Mr. Mayo, on Mr. Dowd's statement about the inconsistency of the thermal policies issued by John Quarles, the Assistant Administrator for Enforcement on May 12, 1972; i.e., the inconsistency with the conference recommendations that the EPA Administrator issued in May of 1971.

I think, Mr. Dowd, that you have to look at the total findings that were announced in the summary of the conference by Administrator Ruckelshaus in May of 1971 and not just one of those many findings. The cumulative weight of those findings is very obvious and is recognized in the preamble to the recommendations where the conferees unanimously agreed to the fact -- right under the recommendations on page 10 of the issuance by the Administrator:

"In order to protect Lake Michigan, the following controls to waste heat discharge are concurred in by the conferees representing Indiana, Michigan, Wisconsin, and the United States Environmental Protection Agency." Illinois is not included. And then it goes on to name the recommendations. That was after the findings were in.

A. Dowd

This thermal situation on Lake Michigan was considered as a whole in May of 1971 when those recommendations were issued. When Mr. Quarles issued his thermal policy -- Mr. Quarles being, again, the Assistant Administrator for Enforcement -- he was fully cognizant, thoroughly versed in the issues of Lake Michigan. He was not trying to slip the Lake Michigan recommendations into the wastebasket by issuing this thermal recommendation. Not only would Mr. Quarles not have any authority to do this, but this isn't the way he does business.

Also, in Mr. Quarles' May 12, 1972, policy, he talks about a case-by-case analysis. He also refers to total cumulative heat loadings. By "total cumulative heat loadings" -- and that is in black and white, as you suggested that the other parts aren't -- he means just what he says: total cumulative heat loadings. This is the situation in Lake Michigan; concern for the total lake.

We know and you know, on the basis of the record of the last conference and this conference, too, that all of the returns are not in by a long shot. Administrator Ruckelshaus, when he made his recommendation and when he addressed a letter to this conference, stated that if he is going to err, he is going to err on the side of safety. And I think that the inconsistency that you pointed out in the Quarles' policy versus the Administrator's announcement is, in fact, not an inconsistency at all.

MR. DOWD: Mr. McDonald, the inconsistency that I am noting is not between the 1971 policy by the Administrator and a May 1971 policy by Mr. Quarles. I am addressing myself to an inconsistency between what is stated here in a September 1971 report and what Mr. Bryson told us this morning. This is a September 1972 report submitted to the Lake Michigan Enforcement Conference.

MR. McDONALD: Well, let me tell you -- you are talking about the last statement Mr. Bryson concluded on the --

MR. DOWD: I am talking about Mr. Bryson's statement after reading this which talks about case-by-case with some collective evaluations where necessary. Mr. Bryson then concluded his remarks with something that was not in here; he said that this does not represent any deviation from the Administrator's position, as expressed in his May 1971 letter, and in the recommendations of the conference of May 1971.

MR. McDONALD: And Mr. Bryson is absolutely right; it doesn't. And the reason Mr. Bryson inserted that was, again, I think, for a fairly obvious reason: some of it relates to the newspapers, again.

MR. DOWD: Mr. McDonald --

MR. McDONALD: There has been speculation that this conference recommendation does not stand. It does stand.

MR. DOWD: -- could I just ask one question? I don't mean to be argumentative.

MR. McDONALD: Well, I don't either. But I think this is a fundamental point.

MR. DOWD: This is a report of the Lake Michigan Enforcement Conference. We are not directly concerned with what the policy is with respect to other bodies of water in the United States.

Now, if the EPA policy is still that every thermal discharge into Lake Michigan should be confined to a mixing zone of 1,000 feet with a 3° maximum at the edge, why in heaven's name didn't you state this or reaffirm it explicitly in your report?

MR. McDONALD: For a very, very simple reason -- and I am surprised that you raise this point. I am glad that you raise it, from another standpoint.

The conference recommendation has been made. It has been announced. It stands.

MR. DOWD: This could very well supersede the conference recommendation, it seems to me.

MR. MAYO: If Mr. Quarles intended that his policy was going to supersede the recommendation of the Lake Michigan Enforcement Conference or any other conference, Mr. Dowd, I think he would have said so.

MR. McDONALD: Well, I think additionally that Mr. Ruckelshaus who had issued it -- he is the one that changes any recommendations in the conference, not Mr. Quarles.

MR. HENRY: Well, I think it is perfectly clear you are trying to supersede Mr. Quarles.

MR. McDONALD: I think we have spoken to this point, and I am glad you brought it up from the standpoint of, if you think there is an inconsistency, there is certainly no inconsistency on our part. The recommendation was made in May of 1971 when the Administrator, who is the one who has the authority to make the recommendation, made it. The Administrator has not changed his recommendation, and the recommendation is in toto, that is the entire conference summary that he issued in May of 1971, which includes the 1,000 feet and the 3°.

MR. DOWD: And your statement, on page 18 of this report, which is only a few weeks old, says that: "To determine the impact of this policy" -- that has to be Mr. Quarles' policy -- "on thermal discharges to Lake Michigan, one must conduct a thorough assessment of each major heat source individually and collectively ..." --

MR. McDONALD: I fail to see any problem in that statement.

MR. DOWD: Why conduct these surveys if you have already decided that all plants have to be confined to a 1,000 foot radius, as far as the mixing zone is concerned, and that all future plants, and possibly those under construction, must be constructed with closed cooling systems?

MR. McDONALD: One of the reasons this conference session was reconvened, again, was a very elemental reason: There has been a good deal of controversy on the recommendation that the Administrator issued in May of 1971. This is a matter of public record. Three of the four States do not agree with the recommendation.

The conferees, the States were called back into session to give not only them but the Federal Government, and to give obviously affected parties, such as your company, an opportunity to come back into this session, so we can look at the total record again.

In the meantime, this recommendation still stands.

MR. DOWD: I am glad we have clarified that, Mr. McDonald. Thank you.

MR. MAYO: I have one comment. I think, Mr. Dowd, it is appropriate, when you are making reference to the findings of the conference, not to be as selective as you were. Because it seems to me you implied that, on the basis of Finding No. 1, that there was adequate justification for considering the large thermal dischargers into Lake Michigan on exclusively a single-plant-by-single-plant basis.

I think perhaps you overlooked and maybe you ignored the Finding No. 16 which says: "Discharges from a single large plant located in a spawning ground or across a migratory route could significantly disrupt the balance of the affected species throughout the lake." And I think, on the basis of that finding, if there was no other finding made, you just have to take the time to look at the plants in some collective fashion.

MR. DOWD: Mr. Mayo, that strikes me as looking at the effect of an individual plant and determining whether its thermal effluent goes into a spawning ground. We have no quarrel with this at all.

MR. MAYO: Any other comments, gentlemen?

MR. McDONALD: I would like to add one thing. It relates to Mr. Purdy's testimony. If I understood his testimony right, he is looking at the total lake also and not on strictly a case-by-case basis, but for total protection of that lake, even though all of the parameters aren't in, in terms of his ability to assess that.

MR. MAYO: Any other comments, gentlemen?

MR. PURDY: That completes, to my knowledge, those that wish to make statements for Michigan.

MR. MAYO: Gentlemen, if I could have a word with the conferees for a minute, off the record, if I may.

(Discussion off the record.)

(Short recess.)

MR. MAYO: May we have the conferees at the head table?

Ladies and gentlemen, in keeping with the agenda, the next presentations will be those of the State of Illinois and the Illinois interests.

Mr. Blaser.

STATEMENT OF WILLIAM L. BLASER,
DIRECTOR, ENVIRONMENTAL PROTECTION AGENCY,
STATE OF ILLINOIS
SPRINGFIELD, ILLINOIS

MR. BLASER: In order to help clarify the situation with the Illinois regulations on thermal as compared to the conference recommendations, I have a statement here.

W. Blaser

Copies are available.

The Illinois Environmental Protection Act requires that all regulations, including thermal standards, be set by the Illinois Pollution Control Board, of which David Currie is the Chairman.

It is further required, under the Act, that this be done based on facts established by open public hearings with sworn and recorded testimony, rules of evidence, right of cross examination, and Board-written decisions and supporting reasoning.

No matter how strongly the Federal Government recommends a thermal standard through this conference, Illinois can only adopt enforceable standards through presentation of evidence to the Illinois Pollution Control Board.

This fully-recorded process was followed in a series of open hearings, and participation in workshops held in early 1971 to establish "Thermal Standards for Lake Michigan" (PCB R-70-2). Copies have been made available to all conferees and are available to members of the audience.

In this opinion, our Pollution Control Board has spoken quite eloquently to the concern that Illinois has on thermal enrichment of Lake Michigan. Details of the Illinois position on the thermal standards and that of our regulations follow.

The recommendation of the 1971 conference was that each discharger shall complete preliminary plans for appropriate facilities by December 31, 1971; final plans by June 30, 1972; and place such facilities in operation by December 31, 1973, for off-lake cooling.

Our Board concluded after extensive public hearings that there was insufficient evidence of significant ecological damage to require the existing heat sources to backfit cooling devices. The Board does require, however, that the source of heated effluent demonstrate in a hearing before the Board within 6 years that the discharge from that heated source has not caused and cannot reasonably be expected to cause significant ecological damage to the lake.

The regulations also provide for the requirement of backfitting of alternative cooling facilities, if it is found at any time that any heated effluent causes significant ecological damage to the lake.

As far as new heated effluents, our Board has spoken to its concern on the matter of siting of additional large heat sources on the shores of Lake Michigan. Our regulations require in Rule 206e (3) (A) that no source or heated effluent which was not in operation nor under construction as of January 1, 1971, shall discharge more than a daily average of 0.1 billion B.t.u. per hour. We are aware plans to locate an additional heated effluent on the Illinois shores of the lake.

As to mixing zone, the recommendation of the conference was: "... at a maximum distance of 1,000 feet from a fixed point adjacent to the discharge."

The Illinois regulations, Rule 206e (1), identified the mixing zone as "... shall be no greater than a circle with a radius of 1,000 feet or an equal fixed area of simple form."

The concept of mixing zone is further explained in our Rule 201a which requires case-by-case evaluation with the following items to be considered: The character of the body of water; the present and anticipated future use of the body of water; the present and anticipated water quality of the body of water; the effect of the discharge on present and on anticipated water quality; and the dilution ratio and the nature of the contaminant.

The 1971 conference further recommended that the receiving water not be more than 3° F. above the existing natural temperature nor should the maximum temperature exceed the monthly maximum limit. The Illinois regulations do reflect this requirement.

Water Intake: "Design to minimize entrainment and damage to desirable aquatic organisms." This requirement is reflected in Rule 206e (2) (F) which states: "... all reasonable steps shall be taken to reduce the number of organisms drawn into or against the intakes."

The existing Commonwealth Edison Company, Waukegan Works, has an intake bay and channel with fish nets. The Zion facilities are being designed to comply with these requirements.

Recommendation: "Thermal plumes shall not overlap or intercept."

The Illinois regulations reflect this requirement in Rule 206e (2) (E) which states "... heated effluents from more than one source shall not interact."

Recommendation as to temperature and flow records: Operating reports are required from the existing Commonwealth Edison Company facility and are submitted on a monthly basis.

Finally, the intake structure design: We have compiled some data on the design of the intake structures at existing water plants and industries utilizing Lake Michigan water. We have no evidence of "significant ecological damage" to the lake as a result of withdrawing organisms from the lake.

Any questions?

MR. MAYO: Any comments or questions, gentlemen?

MR. McDONALD: Mr. Blaser, what type of temperature flow records do you require? Do you have a special form that is filled out?

MR. BLASER: We have a requirement. We have spent a good period of time -- I will turn to Mr. Blomgren, who is more familiar with that detail.

MR. BLOMGREN: We require them to report the daily minimum and the daily maximum temperatures for each day of the month and submit reports monthly.

MR. McDONALD: And these are all company reports?

MR. BLOMGREN: Yes, sir. As every discharger in Illinois is required to submit operating reports, so is Commonwealth Edison. We supplement their reports with our surveillance and monitoring data.

MR. McDONALD: In regard to the Zion facility, will the Zion facility have the same reporting requirements as the city of Waukegan facility now has or will they be additional?

MR. BLOMGREN: We see no reason to ask for any more at Zion than we now do in Waukegan.

MR. McDONALD: Could you itemize what you have asked? Do you have a form that --

MR. BLOMGREN: No. They are reporting currently daily minimum and daily maximum temperatures.

MR. McDONALD: And that's it.

MR. BLOMGREN: And flow.

MR. McDONALD: What about special monitoring requirements in the lake itself? Will any monitoring requirements be imposed upon the company or have such requirements been imposed?

MR. BLOMGREN: They are currently engaged in an operating report survey, yes.

MR. McDONALD: Is that a survey that was designed by the State of Illinois, or was it formulated by the company?

MR. BLOMGREN: It was company-formed.

MR. McDONALD: Did the State participate in the design of the monitoring --

MR. BLOMGREN: We reviewed them with them.

MR. McDONALD: Is that in a special write-up or do you have criteria against which you assess that, or what was the developmental process of the monitoring?

MR. BLOMGREN: Something like that is reviewed in our permit section. The proposal was submitted by Commonwealth Edison and reviewed in our permit program and concurred with.

MR. McDONALD: And how far does the monitoring extend into the lake?

MR. BLOMGREN: I am sorry. I do not know that right offhand. We could get that information for you.

MR. McDONALD: Do you know of any source of information that you will be receiving to assess the total effect, say, of the Zion discharge if it doesn't have polluting power into and upon Lake Michigan, similar to what Mr. Purdy suggested he might want to look at?

MR. BLOMGREN: Yes, sir, certainly. Our regulations do require pre- and post-operation surveys. They are engaged in pre-surveys right now.

MR. McDONALD: In terms of total impact on the lake, do you know of any data that you will be receiving from the Federal Government or the other States, or whoever, to make this assessment?

MR. BLOMGREN: I do not, no, sir. I don't; not on the total lake.

MR. McDONALD: Do you think this is important?

MR. BLOMGREN: It certainly has to be taken into account.

MR. McDONALD: Do you think it is an essential ingredient of information that the State of Illinois should have to assess the large volume heated discharge into the lake -- a volume such as represented by the Zion plant? Or do you think, in the alternative, this should be decided just on local environmental damage?

MR. BLOMGREN: I think from what we know today it has to be handled on the basis of local improvements, but there is no doubt that the total effect has to be considered.

MR. BLASER: May I add to that? As I understand it, if there is local -- first of all, we do have the requirements that if there is local damage, we would require of the plant backfitting. Second, we have the survey going on -- not the physical but the aquatic biology -- to give us a benchmark against which to measure. We have proceeded to do that and we anticipate doing that.

Should we find local damage, obviously backfitting would be required. If anyone has evidence to lakewide damage, obviously that would also require backfitting.

MR. McDONALD: When you say you would require backfitting, Mr. Blaser, what do you mean? What would be your criteria for assessing that backfitting would be required at Zion if the plant proceeds without damage?

MR. BLASER: I think the heart of your question is: What is significant ecological damage; what is, in effect --

MR. McDONALD: No. My question is: What criteria

-- what parameters are you going to use so that you can make a judgment that would trigger a backfitting directly to the company?

MR. BLASER: Well, I may not have made clear the limitations of our agency. Essentially what evidence we have would relate to the Pollution Control Board.

MR. McDONALD: I am sorry, I didn't understand that. Would you repeat that, please?

MR. BLASER: The evidence that we would have would be laid in front of the Pollution Control Board. It is their judgment as to whether it represents significant enough damage to cause backfitting to be required.

MR. McDONALD: Well, let me ask Mr. Currie. Maybe he can comment on what criteria or what parameters the Board could take under consideration to make this type of judgment since this appears to be a one-of-a-kind type of judgment that would be made in time.

MR. CURRIE: The opinion that the Board wrote, in adopting the standards, goes into some detail in discussing the types of damage which can occur from the input of heat to the lake. We would, of course, be looking for evidence of that kind of damage or any other kind of damage that might be presented if a case were brought to us under this provision.

W. Blaser

I don't think it is possible, at this point, to speculate with any degree of concreteness as to exactly how many fish would have to be found to be killed, over what period of time, or what degree of increase in the production of undesirable algae in order to trigger a backfitting requirement. For this reason, the regulation was left very general. It speaks in terms of significant ecological damage. We would want to know the number of fish killed. We would want to know the amount of effect on algae. We would want to know the size of the area affected. Any facts which would be brought before the Board would be considered by the Board in determining whether or not the damage done was significant.

MR. McDONALD: Was it the Board's intent at the time you passed that regulation to impose some of these self-monitoring requirements, such as fish kills, entrapments, upon the company itself to report to the agency? Was that part of your hearing consideration?

MR. CURRIE: What the regulation says on that is that the company shall submit such reports as will be required by the agency because we felt they were in a better position to determine than we were precisely what kinds of reports they needed in order to help them perform their surveillance function. We certainly contemplated that the agency itself would conduct whatever surveillance on its own it felt necessary to see to it that the company was giving all of the relevant information.

MR. McDONALD: Does the Board itself in Illinois have any responsibilities on a question like this regulation to ensure itself that the agency will accumulate the necessary evidence, or is your responsibility done when you pass your regulation?

MR. CURRIE: I think one could say that the Board has a continuing responsibility to consider whether or not the regulation is adequate, and if there is some way it comes to our attention that inadequate information is being gathered as a result of some provision of the regulation not being strong enough, then we would undertake, on our own, to the extent that we have had the necessary information, to change the regulation.

But, basically, once the regulation is passed, the enforcement of it is left in the agency's hands and we don't act again until and unless someone brings a case before us for enforcement of the regulation.

MR. McDONALD: Is there any ability to act on your own initiative in a case of sufficient magnitude?

MR. CURRIE: Not with regard to enforcement, no; with regard to the amendment of the regulations, yes.

MR. McDONALD: Thank you, Mr. Currie.

MR. BLASER: Might I add that the Board can request information from the studies and they have done so in the past in other matters.

MR. McDONALD: Would it be possible for your agency, Mr. Blaser, to make available to the conferees within the next week, the full extent of the monitoring program and reporting program that you have imposed upon the Zion facility and the Waukegan plant?

MR. BLASER: This can be done. Some requirements are built into the permit that we issue for the discharge; others on an informal basis. We can consolidate both types and provide the information to you.

MR. McDONALD: I would be interested in one other item also and that is whether there is any mechanism by which the company will report damages that they discover as far as the official reporting procedure -- that is fish kills that would occur in the vicinity of the plant discharge and any entrainments that might take place -- whether you have any requirements along this line.

MR. BLASER: I would like to review the permit requirements and the informal agreements and consolidate them for you.

MR. McDONALD: Very good. Thank you.

MR. MAYO: Any other comments or questions, gentlemen?

Please go on, Mr. Blaser.

MR. BLASER: All right. The next speaker we have is David Comey representing the Businessmen for the Public Interest. He is going to have to leave. Here he is.

Mr. Comey.

STATEMENT OF DAVID DINSMORE COMEY,
DIRECTOR OF ENVIRONMENTAL RESEARCH,
BUSINESSMEN FOR THE PUBLIC INTEREST,
CHICAGO, ILLINOIS

MR. COMEY: A little while ago there was a voice from the audience and when asked who it was, he said, "Henry." That was Henry the Eighth! (Laughter)

I would like to begin by correcting one item on the record. On pages 14 and 15 of the EPA statement this morning, there is a lawsuit identified as Businessmen for the Public Interest versus the Atomic Energy Commission. The correct name of that suit is David Dinsmore Comey versus the Atomic Energy Commission. It has a nice David and Goliath ring to it. (Laughter)

The last time I appeared before the conferees was

D. Comey

in March of 1971, at which time we had just concluded an agreement with the Consumers Power Company to install cooling towers at the Palisades plant. At that time, I indicated that it might be necessary for us to enter into further proceedings, and we were obliged to, in the case of Wisconsin Electric Power. We filed an intervention on the 5th of April of 1971. That proceeding is still going.

The company received a 20 percent license in June, which was stayed by the United States Court of Appeals for the Seventh Circuit. The plant is now operating at 20 percent power since the end of July. However, the matter is on appeal before the Appeal Board of the Atomic Energy Commission, and based on recent oral argument, the license may be removed.

I bring this up because an outgrowth of the Palisades case was the Calvert Cliffs decision. The briefs in that case were written by the Palisades lawyers and, as you know, the Atomic Energy Commission was severely called down for its environmental policies with respect to not only thermal pollution but the general effect or the environmental effects of powerplants.

What we have found in the long protracted hearing before the Atomic and Safety Licensing Board in the Point Beach case is that the power company there — Wisconsin

Electric Power -- like all of the other power companies is stating and attempting to prove that "there is no evidence of significant adverse effect" upon the environment from the operation of the plant, at this point.

I would submit that a man sitting in a room with his eyes screwed tightly closed also would be unable to observe any evidence.

Wisconsin Electric Power tried to prove that it would have no significant -- the plant would have no significant adverse effect and was unable to do so at the hearing in June in Milwaukee. They essentially depended upon a $15,000-a-year study. And I might point out the reason I mention the cost of the study was that at the same time, they were spending over $1 million a year on advertising; and one year they spent $26,000 for a political lobby; so this gives you some idea of their priorities about Lake Michigan.

The Atomic Safety and Licensing Board, on the basis of the evidence, decided that no weight could be given to that study; just wasn't enough. The Board, for some reason, decided that the literature survey that the Atomic Energy Commission staff had made was sufficient to license the plant. That is now the subject of the appeal.

I would like to point out though that the Board did order the applicant to do surveillance, and the testimony that we heard in August in Milwaukee was that the cost of that surveillance at the Point Beach plant for the first year may approach the order of $1 million.

Now, there is a big difference between $15,000 a year and $1 million. You can do a lot more research. But the utilities, despite all of their protests about "there is no evidence" have not been doing any significant funding of research to determine whether or not there are any significant effects.

Consequently, I find that much of the testimony which comes in, in these cases, and which you are about to hear from Commonwealth Edison -- I have read it -- really has a very, very thin data base.

I think it is also interesting to notice that Dr. Stoermer -- although he testified at the Point Beach hearing that as far as he was concerned the Point Beach study was sufficient to warrant licensing of the plant -- in a memorandum, which was found later, that had been written prior to the hearing, Dr. Schneider had recommended to the Atomic Energy Commission that the study was not sufficient, and had indicated also that he thought the AEC ought to tell it like it is in its Environmental Statement. Dr. Schneider's remarks were not incorporated into the

D. Comey

Environmental Statement because generally no adverse comments are included in these statements.

I have been reliably informed by people at Oak Ridge that Lester Rogers, who is the head of the AEC Division of Environmental Surveillance -- or whatever it is called -- systematically edits these things out. One of the most frequently edited words is the word "not," such as in the phrase, "The applicant's program is not sufficient."

(Laughter)

As a result of a decision which was reversed, or a decision which was actually on appeal from the Appeal Board, we are now able to subpoena people from the National Labs who prepared these reports for the Atomic Energy Commission. If there are any Argonne people here, I would like to tell you that in the case of Zion and Kewaunee we will be seeing you.

I might point out also that in the Palisades Environmental Report, which was not prepared by Battelle or by Argonne, but which was prepared by Oak Ridge -- a truly competent organization -- that the Environmental Report said that the environmental studies that had been done at Palisades were clearly not sufficient. Now it was rather interesting for the regulatory staff of the AEC to take that position in the Palisades case because Palisades had already agreed to build a cooling tower, so that the staff was safe in actually revealing the rather shabby study that was done on that.

Now the AEC had the nerve today to say that they welcomed input. I noticed that they confined it to the Federal agencies and to the State agencies. I might point out that they ignored the public.

When we put in rather lengthy comments -- I think some 145 -- rather specific comments on the Point Beach case, on the Environmental Report, the Atomic Energy Commission refused to print them and react to them, as they are statutorily required. They said that they were litigation documents, that they were not required to intervene.

That is what I would characterize as metahypocrisy, that is a hypocrisy piled on top of a hypocrisy.

In effect, what I am saying is that if the conferees sometimes think that the AEC can be trusted to protect the environment of Lake Michigan, they are dead wrong; the record is quite the opposite. And I am not so sure that we can trust the States either.

Mr. McDonald said that had the original mixing zone criterion been 998 feet, it would have appeared that a great deal of thought had gone into that, which is why, when I saw the 3,400 foot requirement in the Michigan order, which was published December 17 of 1971, I thought, "That is a very unusual figure." It says, "Waste discharges to Lake Michigan shall be treated or controlled in such a manner and by means of such facilities that they shall: Not increase the natural temperature of the lake at the edge of the mixing zone, which shall not exceed an area equal to the area of a circle 3,400 foot radius by more than 3° F. ..."

I thought, "That is a very interesting number." I mean it is not a multiple of pi, and it is not a natural number, and I thought I had seen it before. So I did some looking around, and I examined the document entitled "The Donald C. Cook Nuclear Plant Supplementary Environmental Report, Indiana-Michigan Power Company," and there in that document I found at page QC 3-6 calculations showing that the maximum area that the Cook Plant 3° isotherm would occupy was the area of a circle with a radius of 3,400 feet.

So I draw my own conclusion about how Michigan's thermal criteria was reached.

I would like to point out also that I have noticed today in Mr. O. K. Petersen's testimony for Consumers Power Company, on page 6, that they estimated the total cost of equipping their 7,500 MW electrical system with cooling tower, and it comes out to $244 million. That works out to $32,000 per MWE.

D. Comey

I notice in Mr. Butler's testimony, which he is about to give, that their cooling tower at Zion is going to cost them $124 million for a 2,200 MW plant, and that is about a $56,300 per MWE.

Since I think that both of those figures are abominable, I would really suggest to the utilities that if you are going to dispense money you ought to get together on it.

I would like to end by saying I don't think there is any evidence that no significant harm is going to be done to the lake by the powerplants that are scheduled to go into operation. That is one of the reasons we have intervened.

I am not so sure there is evidence that there is going to be harm. All I would say is that I am not sure it is a scientific decision.

Dr. Charles Coutant, of the Oak Ridge National Laboratory, the AEC's expert on fish, appeared as our witness -- the intervenor's witness -- in the Point Beach case. And he said that if you wanted to solve the thermal problems, that you should build closed-cycle cooling systems, and he said it wasn't a scientific decision; it was a social decision.

And I agree with that, and that is what these conferees have got to wrestle with. Thank you.

MR. MAYO: Any comments or questions, gentlemen?

Mr. McDonald.

MR. McDONALD: How many cases, Mr. Comey, has BPI intervened on Lake Michigan?

MR. COMEY: Well, the Atomic Energy Commissioner has not responded to our petition to intervene in Point Beach 1, Kewaunee, Zion 1, Zion 2, Cook 1, Cook 2, so I am not in a position to say. We filed a petition to intervene that ran to something like 300 specific contentions. My guess is that we will be admitted.

We are presently involved in the Bailly Nuclear Generating Station construction permit hearing, and also in the Point Beach Unit 2 operating losses hearing. The Palisades matter we are still a party to, but not active.

MR. McDONALD: Is it BPI's intention to intervene in every case?

MR. COMEY: Well, in effect we have, yes. There are no other reactors that we have located at least yet.

MR. McDONALD: Is the main thrust of your intervention what you summed up in your last minute or two?

MR. COMEY: Oh, no. The main thrust of our intervention is that these nuclear powerplants are incredibly poorly built; the applicants do not have sufficient technical knowledge to operate them safely; and that the design of the plant is seriously deficient so that there is a grave risk that there will be accidents which will kill millions of people. That is the more important aspect of our intervention.

MR. McDONALD: When you talk social risk, you were talking about heated discharges. Do you have anything else that you will be presenting at the interventions besides this social thrust?

MR. COMEY: Oh, yes. I think we will probably have witnesses rather like we had at Point Beach, where we brought in Dr. John Bardach from Hawaii, and Dr. John Neess from the University of Wisconsin. And if Mr. Mayo will authorize his use again, we will have Dr. William Brungs of the EPA who, I might add, I'd like to thank the EPA. He was a very convincing witness. He wouldn't say all of the things we wanted him to say, but he sure was convincing.

MR. McDONALD: Thank you.

MR. MAYO: Any other comments or questions, gentlemen?

Thank you, Mr. Comey.

MR. COMEY: Thank you.

MR. BLASER: The next witness we have from Illinois is Mrs. Lee Botts of the Lake Michigan Federation.

STATEMENT OF MRS. LEE BOTTS,
EXECUTIVE SECRETARY.
LAKE MICHIGAN FEDERATION,
CHICAGO, ILLINOIS

MRS. BOTTS: Thank you.

I would like to express appreciation to Commonwealth Edison for agreeing to allow the citizens of Illinois to proceed this afternoon. We had a number of people here yesterday who were not able to return from out of State, but we appreciate being allowed to enter statements on behalf of a number of people who have had to leave today.

I will submit for the record a collection of letters received by Mrs. Angela Pieroni, who appealed through Letters to the Editor in Chicago papers for expressions of concern about the lake for her to submit to this Enforcement Conference.

I have also submitted written statements from Jack Berghoff, an attorney, who lives in Chicago and has a summer home near the Cook plant in Michigan, expressing his concern about the potential thermal pollution of the lake; and from Mrs. Gloria Bateman for the Conservation Committee of the South Shore Commission, a community organization in

Chicago, which represents 90,000 residents. Copies of those statements and of the letters have been made available to the conferees.

(The documents above referred to follow in their entirety.)

PRESENTATION OF POSITION PAPER OF SOUTH SHORE COMMISSION

TO LAKE MICHIGAN ENFORCEMENT CONFERENCE ... September 21, 1972

This statement is submitted on behalf of the Conservation Committee of the South Shore Commission, which represents 90,000 residents of this lakefront community in the city of Chicago.

Lake Michigan has always shaped the destiny and defined the quality of life for those persons living along its shores, and its influence has been most dramatic at the southern tip of Lake Michigan where our community resides. We find that as citizens we must, with increasing frequency, protest the encroachment of industry upon our natural environment and protect those interests which are the basis of our physical welfare and mental health.

We are at this Conference to consider the effect of thermal emmission into Lake Michigan caused by atomic power plants constructed along its shores in order to stop existing polluting conditions and forestall future potential hazards to the waters. The lake is not a limitless resource ... the waters do not rejuvenate themselves; they already show evidence of being unable to throw off current abuses by the polluting industries that dot the entire shoreline of Lake Michigan. Studies show the lake cannot take any more abuse and yet live, fulfilling its function as a life supporting resource.

We therefore plea for more specific guidelines and effective enforcement agencies to safeguard the physical needs and safety of communities abutting industrial plants. No individual, government, organization or industry has the right to expel harmful elements into the air and water which even remotely change the natural elements, thus imperiling all life forms.

(more)

We are well aware that atomic energy is the energy of the future. We are not here to fight progress, but we want assurances that technical progress will not endanger the quality of our lives or the enjoyment of our natural resources. We are much concerned about the promiscuous use of these resources by industry.

We would, therefore, present the following recommendations for your consideration:

1 - We request the banning of new power plants on the lake.

2 - We urge State legislation and enforcement of the guidelines and recommendations of the EPA banning thermal discharges in the lake by existing power plants.

3 - We recommend the appointment of interstate agencies to ensure formulation of uniform legislation protecting those areas and resources commonly held and enjoyed by two or more States.

4 - We request greater cooperation on the part of industries to seek and implement ways to further their development without sacrificing our natural resources.

We join with the Lake Michigan Federation and other conservation organizations in insisting that the public be kept fully informed and included as a participating body in future planning of nuclear power plant installations in the Midwest.

Respectfully submitted by

The Conservation Committee of the

SOUTH SHORE COMMISSION

per: Mrs. Harry Golder, Chairman
6843 South Chappel
Chicago, Illinois 60649
(DO 3-8388)

LAKE MICHIGAN ENFORCEMENT CONFERENCE
STATEMENT OF JOHN C. BERGHOFF
THERMAL STANDARDS
SEPTEMBER 20, 1972

My name is John C. Berghoff. I have spent most of my years living near or on the shoreline of Lake Michigan, in the States of Illinois, Indiana, Wisconsin and Michigan. For the past ten years I have owned lakeshore property in Michigan and have spent my summers there. I speak on my own behalf and on behalf of many other shore property owners in and near Bridgman, Michigan.

I wish to record my strong feeling in support of the proposed thermal discharge standards adopted at the March 1971 Conference. I strongly support the effort to prevent deterioration of the quality of our natural resources rather than later seeking to repair the damage done.

I have no quarrel whatsoever with the nation's need for more electrical energy nor with the concept of nuclear plants as a means of providing this additional energy. I do strongly object to the way in which the power companies seek to use natural resources such as Lake Michigan as private industrial waste ponds. I resent their arrogating the waters of the Great Lakes to themselves as though they had bought and paid for them, as though there were no future generations with which to be concerned.

The nuclear plant with which I am most familiar is the one now being built on the lake shore at Bridgman, Michigan - the Donald C. Cook plant. To permit a plant the size of this one to draw two billion gallons of fresh, cold Lake Michigan water each day, use it as a coolant in its nuclear processing, and spew it back into the lake daily some 20 degrees warmer than when it was withdrawn is simply unthinkable in this day and age. The American Electric Power Company has announced that this plant will cost almost $600 million, yet this company is resisting the obligation to spend an additional fraction of that investment to moderate the extreme elevation of its proposed waste waters, or for that matter, to assure zero or near-zero radioactivity of the water which it will pour into the lake.

Those of us who have enjoyed the clear waters of Lake Michigan through the years and who have noted the unmistakable decline in its quality recently are shocked that the federal and state authorities are seriously considering surrendering their public responsibility before the arrogant demands of the power companies. No plant the size of the Cook plant should be permitted to commence operations without reasonably moderating its thermal discharge.

In my view the interests of the little people will be best served, and I believe of the power companies as well, long-range, by adopting and enforcing uncomplicated, reasonable but firm thermal standards. These should apply to all power companies, including those who have belligerently proceeded with plant construction in total disregard of the ecological dimensions and despite the clear warnings raised at least two years ago that thermal standards would be adopted. In this way the government will have lived up to its responsibility to meet the need for expanding electrical energy without permitting irreplaceable natural resources to be ravaged in the process.

Thank you.

Respectfully submitted,

J.C. Berghoff

John C. Berghoff

115 W. Jackson Boulevard
Chicago, Illinois 60604

Summer address:
Bridgman, Michigan

LAKE MICHIGAN FEDERATION

53 West Jackson Blvd. | Chicago, Illinois 60604 | (312) 427-5129

September 28, 1972

Mrs. Lee Botts
Executive Secretary
Chicago, Illinois

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Chicago, Illinois

Mrs. Louise Romo
River Forest, Illinois

John P. Sharon
St. Joseph, Michigan

Mrs. Sylvia Troy
Munster, Indiana

Steven Winter
Two Rivers, Wisconsin

Alternates

'alls
eler, Indiana

Arnold Leder
Kalamazoo, Michigan

Glenn Pratt
Enforcement Division
Region V EPA
1 North Wacker
Chicago, Illinois 60606

Dear Mr. Pratt:

Enclosed are copies of statements to be included in the Lake Michigan Enforcement Conference record (as verbally indicated in the record--these are private citizen statements). As indicated to Mrs. Botts' letter of this week. we may have additional input in the form of technical statements. If we do, that information will be sent prior to your one-week extended deadline on closing the conference record.

Thank you for your cooperation in connection with these statements.

Sincerely,

Nancy Flowers

Miss Nancy Flowers
Information Director

NF:lm

encl.

Sept. 20, 1972

LAKE MICHIGAN ENFORCEMENT CONFERENCE
Sherman Hotel - Clark & Randolph, Chicago, Ill.
Bac Arabrian Room - 6th Floor

Gentlemen:

wish to take this opportunity today, to ask some questions which are pertinent, not only to me, but to thousands of other people who are deeply concerned with our total environment.

Hot water by the billions of gallons is the main issue today. The environmental problems, and supposed progress is one of the questions!

Not---what government and state officials wants the public to believe, but the actual truth. Especially for water pollution.

A lot has been said since 1970, but very little has been done. Lake Michigan for instance. We still have most of the same old inadequate laws.

Lake Michigan does not appear to be any better today, than a year ago, yet; state and federal officials say it has improved. To what! To becomming a sewer?

At last years conference the people from the federal government publically, took a tough stand on the thermal question, asking states to adopt strict standards. Only Indiana of the four states around the lake agreed with the federal proposal. Now the federal government must go to court to enforce its proposal, or try for state agreement on a different version.

At that time, the federal government proposed one new regulation, "keep waste heat from nuclear plants out of the lake".

What happened? Now the federal government is trying to back down from the one new regulation itself proposed. Why?

Today, federal & state officials are here to reopen the argument over waste heat, that the public was lead to believe, was settled back in March, 1971.

At that time, you people said, "waste heat from nuclear plants ought to be kept out of the lake to avoid any risk of adding to lake pollution".

But now, the Atomic Energy Commission, & the Utility companies, seem to think that Lake Michigan should be used as a heat sink, and dumping grounds for all its wastes. Why?

For instance, the Zion Illinois Nuclear Power Plant. Construction is almost completed, but no provision for cooling towers or lakes are in the building plans. Why?

A Thermal standard for today is a question for the future. Most conservationists believe the future of Lake Michigan is at stake, and far too important to risk with thermal pollution.

An ounce of prevention, is worth a pound of cure.

True, we cannot prove absolutely that the heat will damage the lake, but the power companies cannot disprove it either.

There is little conclusive evidence about the effects of thermal pollution in the lake. But the question is, "should we go ahead and discharge heated water in much greater quantities into the lake, and take a "wait and see what happens attitude"? Or should we wait until conclusive evidence is in, one way or the other?

The little evidence that is available on the effects of thermal pollution has been financed by the power companies, and their findings are biased to their benefit, and not the benefit of the public at large.

Are we to accept this evidence as absolute fact, without government studies to check its accuracy?

The federal government has known for some time now that there is a great need for this kind of evidence, and since they admit the need, why has'ent the government taken it upon themselves to do the research?

I wish to read a statement made by our President, which was printed in Focus--Chicago Today newspaper, Sunday, March 1, 1970.

Quote--"Here is one area where we cannot wait...if we do not act now it will be too late, possibly ever to act again".

President Nixon in a keynote speech to the National Governors conference in Washington on the importance of improving environmental conditions, e$pecially the pollution dilemma.

The question of money always arises! Our President signed several bills that allocated millions of dollars, and entrusted the states with these tax dollars, to help eradicate the pollution problems that are besetting us all, as soon as possible.

Yet, how much is really being done?

I cannot, and am not, qualified to discuss other states, but I wish to discuss my own State of Illinois, not only from what I read about, and what I hear about, not only from people in my own city, but from people throughout the State.

We are taxed beyond endurance. But yet, if our tax dollar was spent for what it was deemed for, that would be another story.

The 77th General Assembly, of the State of Illinois, passed House Appropriations Bills No. HB-1670, 1671, 1672.

The Environmental Protection Agency was awarded $9,417,900.00 - Pollution Control Board - $673,300.00 - Institute for Environmental Qualtiy - $2,045,000.00, for pollution control enforcement, for the year July 1st, 1971 ending June 30th, 1972. This money not only included the pollution enforcement programs, but also salaries, etc. A total of $12,136,200.00.

Also; in addition, House Bill #1754, to thetune of $1,000,000.00 was appropriated to Attorney General Scott's Environmental Protection Division, from the state, in addition to a federal grant of $250,000.00.

Of course the $1,000,000.00 includes salaries, travel expense, etc.

But, Atty. Genl. Scott, spends the federal grant money how he sees fit, and accounts to no one as to where this $250,000.00 goes.

As a taxpayer I have the right to know just how and where my tax money is going.

I was appalled to see how the Attorney General wastes the taxpayers money, he who is chiefly responsible for initiating, filing, and prosecuting lawsuits, to halt the desecration of our environment by the offending polluters.

In the last three years, he spent $650,000.00 of the taxpayers money on furniture and fixtures. Over $110,000.00, for carpeting alone. Is this what you call money wisely spent?

But most important, we taxpayers who believe we are paying for work being done to correct the horrendous pollution problems of our state, also pay for his public relation expenditures in excess of $120,000.00 a year.

This is ludicrous!

These facts are a matter of public record in the State Auditor of Public Accounts Office, and the Bureau of the Budget, in Springfield, Illinois.

With the millions of dollars spend in our State alone for pollution programs, etc., why is it that we still are plagued with the problem?

This is a sad state of affairs.

Atty. Genl. Scott was elected by the people to serve their interests, and it is his sworn duty as Attorney General to protect the public's interest, and serve the people of this state.

In conclusion, I suggest that the politicians stop serving their own selfish interests, stop catering and pussy footing with industry and businesses at large, and correct the pollution problems, before it is to late. Without the life sustaining elements of air and water, we shall all perish from this earth.

The time is now, for the tomorrows might never come.

Thank you,

Angela M. Pieroni

Ray Lending ▪ Illustrator ▪ 407 Sherman Ave. ▪ Evanston, Illinois ▪ GReenleaf 5-0313

Dear Mrs. Pieroni;

We have read your letter concerning the Lake Michigan Enforcement Conference on Sept. 19th.

As a resident of Ill. who has lived near and on Lake Michigan and enjoyed it these 38 years we are sick of the constant neglect and criminal abuse of this beautiful lake by nuclear dumping and other pollutants.

We thought all this was settled in March 1971 only to learn the Federal government is trying to back down from keeping waste heat from nuclear plants out of the lake.

We demand as citizens our human rights to a clean, decent environment from State and Federal governments and that this come before big business.

Sincerely,

Jill & Ray Lending

Sept. 16, 1972

Dear Ms Pierone,

Since I am unable to attend the Lake Michigan Enforcement Conference, I am writing to you as my representative.

The federal government once again is going against the wishes of the American people in order to promote big business. The fact that they are backing down on the proposal to "Keep waste heat from nuclear plants out of the lake" is a prime example. After March 1971, many of us were led to believe that the nuclear dumping issue was settled.

I am strongly in favor of both the federal and state government adopting a regulation to protect the lake against heat from nuclear plants and other pollutants.

It is past the time that politicians quit looking toward industry's interests only. After all, we elected them and by our taxes are paying them high enough salaries that they don't need to moonlight!

Do we want to see another Lake Erie? Not me, and I'll do more to fight the "man" who tries to further destroy Lake Michigan!

Sincerely,
Ms. Linda Traub
2047 Asbury
Evanston, Ill., 60201

September 12 1972

Dear Mrs. Piersoni,

Please accept my letter as your authorization to represent me + my family at the Conference at the Sherman House September 19+20th.

I am concerned with any dumping of any foreign material into our Lake Michigan.

The Federal + State officials should adopt a strict regulation to protect the Lake.

Violators should be fined and/or loose their licence to operate in Illinois, Indiana Michigan + Wisconsin

The time is now, now years from now.

Mrs. Harry J Schultz
and family
5336 W. 30th St.
Cicero, Illinois

401 Sherman Ave
Evanston, Ill.
August 28, 1972

Ms. Angela M. Pieroni
2732 So. Sacramento Av.
Chicago, Illinois 60623

Dear Ms. Pieroni,

We oppose the dumping of waste heat from nuclear plants and of other pollutants into Lake Michigan. The federal government should adopt a strong regulation prohibiting such pollution of the lake. The regulation should be enforced across the board without special consideration being given to large corporations with political ties in the administration.

Sincerely,

Marilyn Beis
Edward Beis

403 Sherman Avenue
Evanston, Illinois 60202
August 27, 1972

Dear Mrs. Pieroni:

We have read your letter dated August 21, 1972 regarding waste heat from nuclear plants dumping directly into Lake Michigan and agree with you that such continued action is a serious threat not only to the Lake, but to each of us as well.

The Federal government's proposal to "keep waste heat from nuclear plants out of the lake" must not be compromised. Responsible representatives of local, state and federal governments must look to the future, and protect this vital resource on which so many depend.

Very truly yours,

Mr. & Mrs. Jonathan R. Fiske

Aug. 31, 1972

Dear Mr. Pieroni,

We read your letter as citizens of Illinois against dumping in the lake.

Adopt both Federal and State regulations concerning this most important issue. Something has!! to be done to save our Lakes.

Sincerely
Pat & Al Bullock

I am writing this letter as a plea to stop nuclear dumping in Lake Michigan. The lake is beautiful & provides a restful and invigorating atmosphere for the people of Chicago. It is a sin to continue this unnecessary polluting when the effects can be so devastating & disastrous. Something must be done & the people surely have a right to see that their views are recognized.

Anne Bruckman

Reproduced from best available copy.

Aug 30, 1977

To Those Responsible for Lake Michigan,

I am shocked and disappointed in our government for not standing strong against those who want to pollute our lake with waste heat. Nuclear plants are not as important as our lakes & so they must make the adjustment. Please be stronger in enforcing the regulations against waste heat. If there is anything else I can do to help ~~[illegible]~~ our lake - please let me know.

Sincerely,
Chris [illegible]

Aug 31

Dear Ms Pieroni

As a human being living in this environment You have our support Stop dumping at the source... the minds of the men who have no concept of the realities

Sincerely

Tom & Teresa Forman

L. Botts

MRS. BOTTS: I am Executive Secretary of the Lake Michigan Federation, a four-State coalition of citizen and conservation organizations in Wisconsin, Illinois, Indiana, and Michigan.

My statement has been submitted in full to the conferees, and I have tried to abbreviate it in the interest of time, and I will not read the statement in its entirety.

(Mrs. Botts' statement follows in its entirety.)

LAKE MICHIGAN FEDERATION

53 West Jackson Blvd. | Chicago, Illinois 60604 | (312) 427-5129

September 18, 1972

Mrs. Lee Botts
Executive Secretary
Chicago, Illinois

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Grand Rapids, Michigan

Mrs. Louise Ericksen
Racine, Wisconsin

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William A. Kern
Fort Wayne, Indiana

Mike Love
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Lafayette, Indiana

Charles E. Olmsted, Ph.D.
Chicago, Illinois

Mrs. Louise Rome
River Forest, Illinois

John P. Sharon
St. Joseph, Michigan

Mrs. Sylvia Troy
Munster, Indiana

Steven Winter
Two Rivers, Wisconsin

Alternates

[illegible]
[illegible], Indiana

Arnold Leder
Kalamazoo, Michigan

STATEMENT REGARDING CHICAGO-SOUTH END OF LAKE MICHIGAN REGIONAL WASTEWATER MANAGEMENT STUDY, ARMY CORPS OF ENGINEERS

I am Mrs. Lee Botts, executive secretary of the Lake Michigan Federation, a four state coalition of citizen and conservation organizations in Wisconsin, Illinois, Indiana, and Michigan. This summer I have been serving as chairman of the Citizens Advisory Committee on Conservation and Environment for the Chicago-South End of Lake Michigan regional wastewater management study, a position to which I was elected by members of the committee.

The views expressed here are not given on behalf of the citizens committee; rather they are my views stated here because of the impossibility of raising such questions within the context of the advisory committee under the Corps of Engineers prodedures. My views are based on long-term experience with the Army Corps of Engineers, several years of acquaintance with the land disposal concepts of Dr. John Sheaffer , advisor to the Corps of Engineers, and information obtained in connection with the C-SELM study in recent months.

I am here to question again, as I have at every previous opportunity, the motives and capability of the Army Corps of Engineers for planning on the scale involved in the C-SELM study. For the reasons outlined below, I believe that the citizens of the C-SELM study area should insist that Congress refuse either to authorize further regional wastewater management studies elsewhere or to extend the C-SELM study in particular beyond its present stage until the essential condition of local agreement and participation is met. The need for this condition will be amplified after discussion of my objections to the C-SELM study as it has been conducted so far. There are three bases for my objections:

1. The regional wastewater management studies represent the effort of the Corps to reinforce and extend its authority over the waterways in spite of the costly, destructive and often ineffective consequences of use of previous authority.

2. Application of land disposal as the principal means of waste disposal on the scale advocated by the Corps is at best premature and at worst involves deliberate deceit to Congress and the nation.

3. Failure to obtain approval for the study in advance at the state, regional and local levels demonstrates the Corps'

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greater concern for perpetuating its own bureaucracy than genuine concern for dealing with wastewater problems, and may even impede the national effort in this regard. Let me elaborate on each of these points.

1. EXTENSION OF CORPS AUTHORITY

Faced with mounting objections to their activities in flood control that seem more often than not to cause more problems than they solve and invariably cost more than estimated, and with growing public resistance to pork barrel projects of all kinds, in 1969 the Corps policy makers eagerly responded to the idea that they might be able to keep themselves in business by taking over the planning necessary to clean up pollution of the nation's waterways. The possibility was offered that they could not only keep themselves in business by planning for waste disposal on a scale that would necessarily keep them in the the construction business but also, according to the author of the scheme, take advantage of public concern about pollution to fortify the Corps against possible intrusion by the newly organized Environmental Protection Agency.

Notably absent from the Corps decision to intrude itself into the wastewater planning field was any consideration for the fact that EPA had been set up because of the failure of previous agencies, including the Corps, to deal with the problem.

The source of the inspiration for the Corps to become pollution abatement experts overnight was Dr. John Sheaffer, a water and waste disposal expert who left the University of Chicago Center for Urban Studies to become science advisor to the Corps of Engineers.

Sheaffer had gotten his ideas about the possibility of land disposal of sewage effluents from an experiment underway at Penn State University. Throughout the middle sixties he had been working with William Bauer of the Bauer Engineering firm in Chicago in designing a large scale application of the approach in Muskegon County, Michigan. About the time the Muskegon project received the go ahead, Sheaffer convinced the Corps they could apply the same approach on a national scale, and five metropolitan areas were selected, including Detroit, Boston, San Francisco, Cleveland and Chicago.

In Chicago, out of the strength of their conviction that they, and they alone, ought to save Lake Michigan and its tributaries from pollution, the Corps did not bother to wait for Congress to give its approval, as required by law. Instead of getting Congressional authorization for the study before beginning it, the Corps convinced itself that wastewater management ought to involve flood control and invoked their general authority for that purpose. Apparently to make some link to pollution, however, they took advantage of the existence of previous authorization for another study Dr. Sheafferhad also proposed in the name of fighting pollution and used it as authorization to begin the regional wastewater management study. Thus the Corps used a 1969 resolution requested from Congress to authorize a feasibility study for a dike system across the lake to begin a 1971 feasibility study of application of land disposal to wastewater management. Eventually the Corps did obtain authorization for this specific study, but not until it was well along. How they obtained the authorization brings me to the second point.

2. MISLEADING CONGRESS

The Corps says now, whenever aksed why they are making the regional wastewater management studies, that they are only doing what Congress asked them to. In their version, Congress asked the Corps to determine whether zero discharge of pollutants into waterways could be obtained by any means, and to compare the costs.

Congress was and is, of course, concerned about the public demand for cleaning up the waterways. Both Congress and the White House, and especially the latter, are worried about the cost of meeting the public demand. They provided a willing audience to Dr. Sheaffer's assurances that an almost magical solution was at hand and that the Corps of Engineers could provide the means of achieving it.

To some members of Congress, those who were most critical of the Corps' use of previous authority, Dr. Sheaffer argued that putting the Corps into the pollution abatement business would somehow transform the agency. Even many conservationists were convinced by his rhetoric about recycling wastes and failed to protest writing
funding and authority to support Corps development of land disposal plans into proposed water pollution control legislation.

To Congress, the White House and the conservationists, Dr. Sheaffer cited the existence of the Muskegon County project as proof that land disposal is a viable idea. What he neglected to tell them except when pressed was that the Muskegon County system was and is in the process of construction. Above all, he failed to make clear that conclusions about the success of Muskegon County are premature to say the least.

Later, that is more recently, in response to questions about that fact, Dr. Sheaffer and the Corps have sought confirmation of their approach from other sources, looking world-wide for examples of land disposal of sewage to which to point. Most conspicuous among the examples cited is a municipal project at Melbourne, Australia, but here as well as elsewhere, Dr. Sheaffer and the Corps do not dwell on the difference in scale between what has already been done successfully and what they are proposing to do.

At Penn State, for example, the treated sewage from the university containing no industrial wastes has been sprayed on several hundred acres for 10 years, with careful monitoring of the results. There, it is interesting to note, and unlike in the C-SELM study, the sites for spraying were carefully selected after extensive geological and hydrological studies. Results have been most encouraging, while suggesting some factors that must be given careful consideration.

The Penn State experiment shows, for example, that zero discharge of pollutants cannot be achieved with spray irrigation, for soluble nitrates do get through the so-called living filter of the soil. At a recent technical symposium which I attended, this factor was mentioned again and again as one needing the most careful management. Nor has the Penn State sudy provided assurances that heavy metals and toxic substances can be dealt with more easily in such a system, for the effluent contains only traces of either.

In Melbourne, raw sewage, not treated effluent, is flooded onto publicly controlled farm land in a region where the annual rainfall is approximately 20 inches. This experience surely does not answer how to determine the ability of soil in Indiana and Illinois to deal with urban effluent, a question that the Corps did not determine in selecting or proposing the sites designated in its C-SELM study. Indeed, this fundamental qestion was treated in one meeting of the Citizens Advisory Committee for Industry and Commerce as question of technique and not of feasibility; in other words, such essential questions would be answered later and the study was proceeding on the assumption that suitable answers would be found. This, unfortunately, is all too reminiscent of the Corp of Engineers' approach in the past. It does not suggest that the anti-pollution Corps is any different from the dam-building Corps, which brings me to the third point.

3. CORPS HINDRANCE OF WASTE TREATEMENT PLANNING

The fact that the Corps is carrying on its wastewater management studies out of concern for its own perpetuation is demonstrated by the failure to obtain the most essential ingredientfor any planning effort, that is, local agreement to participate. What is happening with the C-SELM study now in Indiana shows how such a short-sighted approach can actually hinder progress toward planning for broader and better sewage disposal systems.

The C-SELM study was launched unilaterally by the Corps of Engineers, without agreement to participate much less invitation to do so by the states of Indiana and Illinois, by reigonal planning agencies like the Northeastern Illinois Planning Commission, or by operators of municipal sewage treatment facilities. Further, the Corps disregarded other or on-going pollution abatement plans except to indicate that the Corps' plan would supercede them, such as the NIPC regional waste disposal system and the water quality standards adopted by the Illinois Pollution Control Board.

While it might appear to one who reads the Corps reports but has no first hand acquaintance with the actual situation that the Corps is consulting local authorities through its steering and advisory committees, in fact the activities of these committees appear to be a paper exercise. Consider, for example, the fact that the steering committee did not meet between February and early summer, and the fact that the Corps called a meeting for tomorrow morning when the Lake Michigan Enforcement Conference is being convened. No consideration was given to the participation of the state and many municipal officials in the enforcement conference.

The disregard for the local planning efforts is particularly flagrant in the C-SELM study area among the five now underway, for in truth, land disposal is being tested by another major agency, the Metropolitan Sanitary District of Greater Chicago. In this area, at least, the Corps cannot claim that it was justified in undertaking the study of land disposal to show that it could be done. The Sanitary District is already showing how it is possible to work with local interests in the land disposal site in its Prairie Plan in downstate Illinois.

By its willingness to accept limitations imposed by the local authorities in Fulton County, including willingness to pay local taxes, the Metropolitan Sanitary District may, indeed, demonstrate the feasibility of land disposal for at least a partial solution to the problem.

By its headlong and heedless push to impose land disposal as the all-purpose solution, the Corps of Engineers may delay its acceptance through the hostility it arouses by its failure to take first steps first. By failing to determine the suitability of the major site, it proposes to use in the C-SELM project, the Corps has aroused opposition to the idea of land disposal anywhere at all throughout the State of Indiana. Last week 1,250 persons demonstrated their unwillingness to accept the Corps' idea of land disposal and their intention to reject altogether any experiment with land disposal as a technique. Some of them are here tonight out of their determination to protect their homes and their land by opposing water pollution control legislation that would fund exploration of land disposal as a technique.

For myself, as the result of investigations of the possibility of land disposal that have gone far beyond any information made available by the Corps, I urge that it not be rejected out of hand. I have learned nothing that convinces me that we are ready yet to apply this approach nation-wide when we do not even know yet whether Muskegon County will work. But I am convinced that the Corps' use of land disposal for its own short-sighted goals is at fault more than the idea itself, an idea that is almost as old as agriculture itself.

Therefore, I urge that our friends in Indiana who fear the consequences for their land of the C-SELM study and members of the public who share my unwillingness to put water resource planning into the hands of an agency as heedless of local concerns as the Corps of Engineers to join together to make certian that the C-SELM study does not proceed beyond the end of its present stage. That is, Congress should not fund implementation or more studies until and IF the states, the counties, the regional planning agencies and the municipalities all agree that they need and want them and believe the Corps can solve their problems. The Office of Management and Budget has already directed that such local approval is a necessary ingredient for any future regional wastewater management studies. In my opinion Congress ought to make it a requirement for furthering any implementation or additional study in the areas where the Corps has already acted on its sole initiative.

Finally, in conclusion, I urge that the Corps' clumsiness not mislead us premeturely to discard land disposal altogether. Rather let us urge our other federal, state and local agencies to assist and allow those communities that want to try it on their own to do so, so that we may profit from their experience. From a few hundred acres at Penn State to the most industrialized and one of the largest nations in the world is too big a jump for application of any technology.

LAKE MICHIGAN FEDERATION

53 West Jackson Blvd. | Chicago, Illinois 60604 | (312) 427-5129

STATEMENT TO LAKE MICHIGAN ENFORCEMENT CONFERENCE,

SEPTEMBER 20, 1972

I am Mrs. Lee Botts, executive secretary of the Lake Michigan Federation, a four state coalition of citizen and conservation groups in Michigan, Indiana, Wisconsin and Illinois.

I am here today to express the dismay of citizens I represent about the continuing federal policy of evasion on the thermal question for Lake Michigan. The truth is that this enforcement conference was called with no intention of making a final decision on whether waste heat from large power plants should be dumped into the lake. This enforcement conference was called in the same spirit in which the thermal question has been dealt with in the past -- not to do it.

In this spirit the Environmental Protection Agency purports to be considering whether it is necessary to protect the lake against thermal pollution but actually is weighing the political pressures. Twice previously it has appeared to the public that the EPA was taking a decisive, firm position in favor of protecting the lake. Each time subsequently the EPA has failed to back up a position made political by failure to support it with scientific evidence. Thus here again we are confronted with a most familiar situation: evasion of dealing with an issue and an almost farcical procedure where the evasion is confirmed and acted out.

In 1970 and again in 1971 the EPA announced to the world the means by which Lake Michigan would be protected from possible thermal pollution, a thermal standard requiring closed cycle cooling systems. Both times the agency's decisive posture ended with the announcement of intention. Consider the thermal report offered by the regional EPA office for this enforcement conference. It consists of a historical review of the past failure of the enforcement conferences to deal with the issue up to the March 23, 1971 proclamation. A supplementary commissioned report is itself confirmation of the failure to seek scientific confirmation of the proposed standard. The report consists of a catalogue of research that in instance after instance was undertaken by and for the vested interest that has most at stake in the decision, the utilities themselves.

The evidence and speculation offered by the utilities may be valid, but the fact of their vested interest puts such research in a political context. The independent confirmation or disputation with results of utility research has not been sought.

Mrs. Lee Botts
Executive Secretary
Chicago, Illinois

EXECUTIVE COUNCIL

Vance Van Laanen
President
Green Bay, Wisconsin

Harold B. Olin
Vice-President
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Chicago, Illinois

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River Forest, Illinois

John P. Sharon
St. Joseph, Michigan

Mrs. Sylvia Troy
Munster, Indiana

Steven Winter
Two Rivers, Wisconsin

Alternates

alls
ster, Indiana

Arnold Leder
Kalamazoo, Michigan

Almost incredibly, there is still no indication of intention to do so. If talk and talk alone, or even with chest pounding, would solve the thermal question, it would have been resolved within the enforcement conference long ago, and we could be moving on to other critical matters. My purpose today is to urge action on both immediate and long term aspects of the thermal question.

The first aspect is whether existing power plants, including those constructed but not yet operating, should be allowed to discharge their waste heat into the lake. The second is whether additional power plants should be located on the lake and allowed to discharge their waste heat into the lake in the future.

PRESENT POWER PLANTS

Whether or not the delay in enforcement action on the federal standard has been intended to make existing plants a fait accompli, that is the result, The public is not misled that the federal government has been powerless in this situation; it is the federal unwillingness to act for which it will be held responsible. Thus, the Kewaunee, Point Beach, Zion and Cook nuclear plants have all reached the operating license stage with once-through cooling systems intact. Any cost of altering these plants by basic changes now is necessarily enormously greater that it would have been even two years ago when the federal government first told us (and already late then) that their waste heat would be kept out of the lake.

It should now be clear that the enforcement conference failure on the thermal question leaves the public with the necessity to seek other ways to resolve it. The Atomic Energy Commission regulations put the burden of proof for the absence of detrimental effects of operation of nuclear plants on the applicant. The Calvert Cliffs decision confirmed the obligation of the AEC to consider thermal pollution as a possible deterimental effect in its license procedures.

What I am saying is that if the thermal question cannot be resolved here, it can and will be raised in interventions in the public interest in operating license procedures. Through the regulatory procedures of the AEC the inadequacy of environmental studies to date for the Point Beach Two plant in Wisconsin was confirmed, with the result that the company is greatly expanding its efforts in this regard.*

The enforcement conference should decide now in this meeting whether it is more appropriate to deal with the thermal question for the lake as a whole or whether it must be left to be decided on a case by case basis through interventions in license proceedings.

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*While the enforcement conference succeeds in passing the buck to the public and the AEC, its failure to act in its area of responsibility for water quality will not be forgotten.

In demanding resolution of the thermal question within the enforcement conference, my organization has been accused by many, including fellow conservationists, of making the thermal question seem to be the only matter of public concern for nuclear plants. The fact is that the enforcement conference is the appropriate place under present law to resolve a water quality question but reactor safety and land use questions cannot be raised here. Worry about the future of the lake aroused the public's concern not only about present plants but even more so about future plants.

FUTURE POWER PLANTS

A decision that the cost to society of back fitting existing plants is not justified will not answer the question of whether decisions to locate future power plants ought to be made in the same way as the siting decisions for the present plants. While the enforcement conference cannot establish the broad criteria needed for the future decisions, it can and ought to be the means for dealing with the thermal question as part of the siting decision.

The utility effort to reinforce their contention that no or negligible damage will occur with operation of present plants scarcely constitutes proof. The limits of their research has been dictated by expedience rather than a systematic appraisal of what needs to be measured. The need for monitoring operations of existing plants independently and of guidelines for the utility research has not been addressed. Yet this would be the way to provide a more rational basis for future decisions.

The need for monitoring is made more critical by the desire of the Atomic Energy Commission to continue use of Lake Michigan as a heat sink--their term not mine. Among the regulatory agencies for Lake Michigan, only the Department of Natural Resources has addressed itself to the need for guidelines for monitoring operation of nuclear plants.

By contrast, the State of Michigan seems willing to leave determination not only of the extent of the effects but of what constitutes effects to the operators of the power plants, as does the federal EPA and the State of Illinois. The EPA might be explained on the grounds that it is at least pretending now that the plants will not be allowed to operate, but the State of Illinois does not have that excuse.

According to Illinois, there should be no more power plants on Lake Michigan, a cavalier attitude indeed unless we are told why. In fact the Illinois Pollution Control Board has determined that the effects of operation of the Zion plant will be so minimal as to be of no concern while also taking the position against additional power plants. While saying that results of operation of Zion would be reviewed in five years, the Illinois Board has not said what would constitute evidence of damage nor how bad it has to be to cause a requirement for closed cycle cooling for Zion. Finally, both Illinois and Michigan are apparently willing to let the utilities decide not only what to monitor but how.

In this situation the Lake Michigan Federation has attempted in recent months, as the evasiveness of the federal EPA has made operation of existing plants with once through cooling almost inevitable, to address the need for monitoring.

MONITORING FOR THERMAL EFFECTS

We are concerned with biological effects on the lake and with the engineering of the plants. For help with the former, last spring we circulated a questionaire to scientists requesting their advice on the questions that seemed important. It was distributed at the meeting of the Great Lakes Research Association in April, and also sent to persons suggested through persons suggested through personal contact.

We could offer no remuneration except the opportunity to assist with an extremely public policy question. The results were suggestive but not conclusive, and yet I hope that by sharing them with you we can inspire the agencies represented here and the enforcement conference to address itself to monitoring as the means to put the thermal question on a scientific and not just political basis.

For help with the engineering questions, we have turned to the Illinois Chapter of the American Society of Professional Engineers. This summer their board agreed that it would be appropriate for members of the society as individuals to offer services to the Federation in this regard. The board stressed that only persons whose career and employment were not directly involved should answer the request, a recognition of vested interest that was refreshing to say the least.

In this case some individuals have offered their services to us and are in process of reviewing materials we have submitted. We do not have results as yet of this effort, but you may be interested to know that we have particularly asked for technical evaluation of the predictions of Dr. Donald W. Pritchard based on his modeling of discharge systems for the Zion plant. The reason for stressing Dr. Pritchard's work was the questions raised about his assumptions in the recent Argonne Laboratory report on thermal plume modeling, and the reliance that has been placed on his predictions by the Illinois Pollution Control Board.

As for our questionaire concerning biological effects, a copy is attached with this statement, together with the memorandum and letter that accompanied it. The single most important conclusion that can be reached from the responses is that measuring thermal effects is a complicated process that no one seems absolutely certain how to do.

That is scarcely news, nor an excuse not to do it as the enforcement conference seems to feel.

Not suprisingly, researchers working for utilities were more willing than others to make definite statements about a time span needed for study and to specify parameters. In short, they found answers easier to come by, which is fortunate to say the least for those with whom they consult. Mos responses stressed the need for research, wihch makes it all the more difficult for us to understand why the government agencies have failed to see that it is done.

One scientist who heads a state agency told us our questions were ridiculous but did not reply when we asked him please to tell us what question we ought to be asking. Another scientist confirmed his ivory tower existence by informing us that we are not using the service we are paying for from government, urging us to use the Environmental Impact Statements of AEC and services of EPA scientists on top of the situation! We have the same problem with AEC impact statements as with utility-funded research, namely vested interest, and unfortunately we have not met any EPA scientists we could describe as on top of the situation.. We do recognize that it is possible they exist and are muzzled by the apparent EPA determination to let the thermal situation proceed without direction from that source.

While no attempt was made to quantify results, the answers to the questionaires did confirm our suspicions on the following points:

1. Sufficient answers to the important thermal questions do not now exist in the scientific literature.

2. Most of the research now underway is being funded by the utility industry.

3. A minimum of five, some believe 10 or more, years of observation will be required to ascertain the thermal effects.

4. In the short term damage to organisms by entrainment will be more obvious than the effects of heat.

5. In the long term the cumulative effect of waste heat from many power plants is likely to be subtle changes in the unique biological character of Lake Michigan.

In conclusion, the Lake Michigan Federation urges that evasion of action on the thermal question not continue within the enforcement conference. This action should include establishment of monitoring requirements for presently existing plants to provide the evidence needed to deal with the question of future plants.

We asked Dr. Stoermer to come to the enforcement conference to demonstrate to you that our fears about the lake have a foundation in fact. Your action now on the thermal question will determine now whether in years to come we will be identifying results of increase in the waste heat load on the lake as he identifies now the result of increase in the phosphorous load. The purpose of the questionaire was to determine whether we were right in the need for scientific research. Answers confirmed that a decision cannot wait for final results of research.

I ask you to consider whether you want to tell your grandchildren and mine what you did to protect the lake or what you michg have done. Thank you.

LAKE MICHIGAN FEDERATION

53 West Jackson Blvd. | Chicago, Illinois 60604 | (312) 427-5129

M... Lee Botts
Executive Secretary
Chicago, Illinois

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Mrs. Sylvia Troy
Munster, Indiana

Steven Winter
Two Rivers, Wisconsin

Alternates

T [illegible]ills
W[illegible]ter, Indiana

Arnold Leder
Kalamazoo, Michigan

March 30, 1972

Sir:

The Lake Michigan Federation is a coalition of citizen groups in Wisconsin, Illinois, Indiana and Michigan. It was organized to promote participation in public policy decisions pertaining to Lake Michigan, its tributaries and its shores.

The Federation will be grateful for your assistance in connection with the enclosed materials.

Thank you.

Yours very truly,

Charles Olmsted

Charles Olmsted, Ph.D.
Biology Department
University of Chicago

Mrs Lee Botts

Mrs. Lee Botts
Executive Secretary
Lake Michigan Federation

LAKE MICHIGAN FEDERATION

53 West Jackson Blvd. | Chicago, Illinois 60604 | (312) 427-5129

TO: Great Lakes Scientific Community

FROM: Lake Michigan Federation

RE: Lake Michigan thermal standard

Guidance is requested from the scientific community concerning procedures for for evaluation of thermal effects in Lake Michigan.

By 1974 several nuclear power plants are scheduled to begin using Lake Michigan water for once-through cooling.

From 1968 to 1970, conservationists urged that the Lake Michigan Enforcement Conference consider a thermal standard to prevent thermal pollution by the nuclear plants. The debate revealed the paucity of pertinent past research on the lake's ecological systems and of field data on thermal effects in the Great Lakes. Utilities expanded their research programs, but to date few results have been reported in the literature. At regulatory hearings consultants to utilities predicted there would be little thermal damage on the basis of laboratory studies and modeling techniques. Government experts, citing effects of heat on fish elsewhere and in laboratory studies, said damage was likely. The conservationists argued that, with the lake at such a critical stage biologically, the heat whould be kept out of the lake or strongly limited rather than risk possible irreversible damage.

In March, 1971, the federal Environmental Protection Agency proposed that closed cycle cooling systems be required for all nuclear plants and some large fossil-fuel plants. Subsequently, on economic grounds and lack of firm evidence of potential damage, Wisconsin, Illinois and Michigan decided to let existing plants and those under construction operate with once-through cooling; only Indiana, where more advanced eutrophication inside an existing heat plume was cited as justification, accepted the federal proposal.

In the spring of 1972, because of this disagreement, another enforcement conference on the thermal question is likely. It is believed EPA will seek a compromise to let existing plants operate but to prohibit additional plants.

The Lake Michigan Federation believes that any such compromise must include a definition of ecological damage. Further, to resolve the thermal question, the standard should state the methods for adequate monitoring long enough for evaluation of subtle as well as gross effects. The monitoring should not be left entirely up to the utilities which have investments of hundreds of millions of dollars to protect.

Your comments will assist the Lake Michigan Federation formulate responsible proposals on monitoring for the forthcoming enforcement conference.

[illegible] Lee Botts
Executive Secretary
Chicago, Illinois

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T[illegible]ille
[illegible]ier, Indiana

Arnold Leder
Kalamazoo, Michigan

Contributions are tax deductible

Note: No one who answers will be named in connection with any Lake Michigan Federation activities without permission in advance. If you prefer, please comment in general on the points raised in the questions below, rather than answering them individually. Please return your comments to the Lake Michigan Federation, 53 West Jackson, Chicago, Illinois, 60604.

1. What pertinent current research do you know of that relates to thermal effects that might result from once-through cooling?

2. How is the research funded (government, utility support, other private sources)?

3. How can damage to ecosystems be adequately measured?

4. How long should operation of once-through cooling systems be monitored to determine subtle effects on ecological systems?

5. How can effects of heat be distinguished from effects of other factors such as chemicals or increased nutrients?

6. What effects other than thermal, such as physical damage or toxicity from chemicals, can occur in aquatic systems with once-through cooling systems?

7. Can damage to aquatic ecosystems be stated in economic terms? How?

8. Is protection of fish, benthos or plankton most important in preventing damage to aquatic systems?

9. It has been argued that fish can and will protect themselves by avoiding thermal plumes; is this true of benthos and plankton?

10. What do you consider the most important question in evaluation of thermal effects/

L. Botts

MRS. BOTTS: I find myself in a somewhat embarrassing position of agreeing with Mr. Dowd about something, and that has to do with the inconsistency of the EPA in confronting the thermal issue.

We do, however, disagree with him on another matter, and that is that we consider any muscling that EPA has been doing to be rather flabby. I am here today to express a dismay of citizens about the continuing Federal policy of evasion on the thermal question for Lake Michigan. The truth is that this conference was called with no intention of making a final decision on whether waste heat from large powerplants should be dumped into the lake. This Enforcement Conference was called in the same spirit in which the thermal question has been dealt with in the past, which was not to do it.

In this spirit the Environmental Protection Agency purports to be considering whether it is necessary to protect the lake against thermal pollution but actually is weighing the political pressures.

The evidence and speculation offered by the utilities may be valid, but the fact of their vested interest puts such research in a political context. The independent confirmation or disputation with results of utility research has not been sought.

L. Botts

The first aspect of the thermal question is whether the existing powerplants, including those constructed but not yet operating, should be allowed to discharge their waste heat into the lake. The second is whether additional powerplants should be located on the lake and allowed to discharge their waste heat into the lake in the future.

Whether or not the delay in enforcement action on the Federal standard has been intended to make existing plants a fait accompli, that is the result.

It should now be clear that the Enforcement Conference failure on the thermal question leaves the public with the necessity to seek other ways to resolve it.

What I am saying is that if the thermal question cannot be resolved here, it can and will be raised at intervention in the public interest in operating license procedures before the Atomic Energy Commission.

A decision that the cost to society of backfitting existing plants is not justified will not answer the question of whether decisions to locate future powerplants ought to be made in the same way. The Enforcement Conference can and ought to be the means for dealing with the thermal question as part of the siting decision.

The need for monitoring is made more critical by the desire of the Atomic Energy Commission to continue use of Lake Michigan as a heat sink -- and that's their term, not mine. Among the regulatory agencies for Lake Michigan, only the Department of Natural Resources has addressed itself to the need for guidelines for monitoring operation of nuclear plants.

According to Illinois, my home State, there should be no more powerplants on Lake Michigan -- a cavalier attitude indeed unless we are told why. While saying that results of operation of Zion would be reviewed in 5 years, the Illinois Board has not said what would constitute evidence of damage nor how bad it has to be to cause a requirement for closed-cycle cooling for Zion.

In this situation, the Lake Michigan Federation has attempted in recent months, as the evasiveness of the Federal EPA has made operation of existing plants with once-through cooling almost inevitable, to address the need for monitoring.

We are concerned with biological effects on the lake and with the engineering of the plants. We have circulated a questionnaire in an attempt to find out what should be the questions. This Enforcement Conference until today has not even defined the problem. It has been a matter dealt with on a strictly expedient basis.

We also requested assistance from the Professional

Engineering Society to evaluate engineering of the plants. I am submitting with my statement a copy of the questionnaire together with requests that we made, addressed to the scientific community of the Great Lakes, and we did receive a number of replies. However we have made no attempt to quantify the results. The answers to the questionnaires did confirm our suspicions on the following points:

1. Sufficient answers to the important thermal questions do not now exist in the scientific literature.

2. Most of the research now under way is being funded by the utility industry.

3. A minimum of 5, some believe 10 or more, years of observation will be required to ascertain the thermal effects.

4. In the short term, damage to organisms by entrainment will be more obvious than the effects of heat.

5. In the long term, the cumulative effect of waste heat from many powerplants is likely to be subtle changes in the unique biological character of Lake Michigan.

In conclusion, the Lake Michigan Federation urges that evasion of action on the thermal question not continue within the Enforcement Conference. This action should include establishment of monitoring requirements for presently existing plants to provide the evidence needed to deal with the question of future plants.

We asked Dr. Stoermer -- who presented his testimony the first day of this meeting -- to come to the Enforcement Conference to demonstrate to you that our fears about the lake have a foundation in fact. Your action now on the thermal question will determine whether in years to come we will be identifying results of the increase in the waste heat load to the lake as he identifies now the result of increase in the phosphorus load. The purpose of the questionnaire was to determine whether we were right in the need for scientific research. The answers confirmed that a decision cannot wait for final results of research.

This morning the Federal EPA reported verbally that its position regarding powerplants on Lake Michigan remains that: 1) controls in the form of closed-cycle cooling systems will be needed, and 2) proliferation of powerplants on the lake needs to be prevented.

The statement did not say what the U.S. EPA would do to accomplish these ends within the Enforcement Conference.

We do not find comfort in the comments by another Federal representative that the EPA could act outside the Enforcement Conference under the Refuse Act Permit Program or intervene in the AEC licensing proceeding. The key is the use of the word "could" instead of "will."

The least that can be done in light of the apparent inevitability of operation of the present powerplants is to record the results to add to the other autopsy records for Lake Michigan. Let us recognize the real function of this procedure we have endured here by giving it the proper name: the Lake Michigan Coroner's Office.

Thank you.

MR. BLASER: The next witness from Illinois is Mark Carter representing Northwestern Students for a Better Environment.

STATEMENT OF MARK J. CARTER,
NORTHWESTERN STUDENTS FOR A BETTER ENVIRONMENT,
EVANSTON, ILLINOIS

MR. CARTER: My name is Mark Carter. I am a student at Northwestern.

The Northwestern Students for a Better Environment wish to express their appreciation for this opportunity to testify. The narrow scope of discussion at this conference on the matter of thermal pollution distresses us. If we are to be environmentalists in more than name only we must analyze a problem from the broadest point of view. Proposed laws and regulations must not solve one environmental problem at the expense of creating another.

In short, we believe that the thermal problem is only a part, but very much related to, the larger problem created by the rapid increase in electrical power consumption. It is like the tip of an iceberg. As we shall show, attempts to deal with the thermal problem independently leads to some very unsatisfactory results. It does no good to restrict thermal inputs into Lake Michigan if provisions are not made for ecologically sound alternatives. The heat must go somewhere.

The Federal Power Commission has predicted that peak electrical demand will go from 277,921 MW in 1970 to 1,056,000 MW in 1990, with a similar increase in electrical energy consumption. This is an average annual growth in consumption of 7.1 percent or a doubling every 10 years. This estimate like previous ones are not just predictions but goals. The Federal Power Commission, the Atomic Energy Commission, the Edison Electric Institute, and especially the power companies will do everything they can to meet the predictions.

There is no reason to assume the situation will be any different in this four-State region. By 1990, with a 50 percent nuclear capacity, the thermal problem will be 5 to 6 times that in 1970. Whether the problem continues to double every 10 years thereafter depends on what approach we take today.

Let's consider the heat balance of Lake Michigan. Over thousands of years the lake has come to a median temperature, after balancing the summer heat and winter colds. Along with this median temperature are both daily and yearly deviations. By natural selection the organisms which inhabit the lake are best suited to its temperature patterns. Substantial warming of local areas essentially excludes those organisms which cannot live and reproduce in the higher temperatures. This may be tolerable if it is limited to small portions of the lake.

However, within several decades, the affected areas will be substantial if once-through cooling, using Lake Michigan water, is permitted. There has been much criticism of the numbers in the Department of Interior 1970 report on thermal effects of Lake Michigan. However, with a 10-year doubling a 50 percent error is erased in only 5 years. Unless we want a lake which is suitable only for catfish and carp, then once-through cooling with Lake Michigan waters is not a long-range solution to the thermal problem.

If the heat is not to be discharged into Lake Michigan, then where? How about the Fox, Des Plaines, Illinois, or Mississippi Rivers? Many of the same arguments listed above hold here, too. The United States Water Resources Council has predicted that, by 1980, one-ninth of the mean annual natural runoff in the United States will be needed for cooling in steam-electric powerplants if once-through cooling is used. A much higher percentage will apply in the industrial areas and during low flow periods. When the cleanup of this region's rivers commences the added heat would make a return to anything resembling a natural state impossible.

One possible solution is to move the power generating facilities out of the region. This is the approach being tried presently in the southwest. Don't waste your time thinking, the idea is already past the study stage. The proposed North Central Power Complex in Montana, Wyoming, and the two Dakotas, will be twice the size of the Four Corners project. All the power will be transmitted to the midwest. Presumably the ecological results will be twice as bad. If we foul up our remaining pristine areas we will have no place to go to recover from living in our cities. The kind of solution that trades the future for the present is no solution at all. We must not force others to pay for our sins.

Another possible solution to the thermal problem is the use of cooling ponds. Let's assume that in 1990 this

M. Carter

four-State region will have an electrical generating capacity in proportion to its share of the Nation's population -- roughly 15 percent. Furthermore, assume a 50 percent nuclear capacity. The land area taken up by plant facilities and cooling ponds alone will cover a minimum of 400 square miles. All the land area of Illinois, Indiana, Wisconsin, and Michigan will be covered with powerplants and cooling ponds in less than 100 years with a continuation of the 10-year doubling. Obviously the situation will not progress that far. Even so, in the next several decades, where will the land come from? When was the last time a powerplant was built without siting problems? Remember, the problem will continue to double every 10 years at the present rate.

A discussion of cooling towers was left for last because, considering present designs, that is only when they should be considered. It is a sham to call cooling towers a solution to the heat discharge problem when they will make matters worse. The reduction in efficiency they cause will necessitate additional generating capacity, increased fuel consumption per kilowatt of electricity produced, and increased thermal loads to be disposed of. Remember that the heat must go somewhere.

Although we are developing means to control and dispose of the more deadly wastes produced in power production, the rapid growth rate aided by reduced efficiencies will overwhelm these efforts. We may now be building plants which put fewer sulfur and nitrogen oxides into the air, but the growth rate in the power industry may result in a net increase in these pollutants. Moreover, less dangerous waste materials such as carbon dioxide will, through volume, become a difficult problem. Again we say one problem must not be traded for another.

Let's look at the efforts of the power industry to solve these staggering problems. In 1970, the industry channeled a mere $46 million -- only 0.23 percent of gross revenues -- into research and development. The President's Office of Science and Technology called this "... a remarkably small percentage by most industry standards," less than one-tenth of the average for American industry as a whole.

In contrast, in 1970, the industry spent $395 million -- 2 percent of gross revenues -- on advertising and sales. This is more than 8 times the amount spent on research and development. How can the industry justify efforts to increase electrical consumption with all the present and future problems unsolved? Some power companies claim they are concerned for our total environment. We say they have contempt for our total environment. They should stand for conservation of energy.

M. Carter

Research and development expenditures should be increased tenfold. The four State pollution control agencies represented here today in consultation with their respective public service commissions should set this as a minimum for allowing the power companies to continue operating. The bulk of this money should be spent in three major areas:

One, on methods of alleviating immediate problems, such as SO_2, NO_x, and fine particulate control, methods to eliminate the discharge of chemicals in cooling water, and last but not least methods of water intake and discharge which will minimize local ecological damage.

Second, ways to utilize waste heat must be investigated seriously. There is not time today to discuss all the possibilities. However, the productive use of waste heat that substitutes for heat energy which would otherwise have to be generated, results in a net improvement in our efficiency of energy use, and in energy conservation. Even though all energy ultimately appears in the environment as heat, energy movement from a highly concentrated point source to a widely dispersed geographic area will be environmentally more acceptable. If we are going to reduce the electrical efficiency of the generating plants, let's do so in order to create a more marketable heat discharge. There are many ideas, a few experiments in progress around the country, but almost no money or commitments to try a full-scale plan. This must change.

Third, large sums must be spent immediately on devising systems for generating electricity more efficiently. This would have beneficial effects on all the problem areas discussed in this paper. Whether topping cycles or new methods altogether are devised is immaterial. However, some ideas like MHD have been around for decades but have died on the vine for lack of attention.

It would be nice if there were technological solutions available for these problems, but none are available today. Even if we embark on an ambitious development program, it would be unlikely that we would have an operational solution in the next few decades. Look at the example of nuclear power. The Atomic Energy Commission has spent billions for nuclear development in the last 20 years. Today nuclear power is producing less than 2 percent of our electric power and it will be several decades more before it is producing over half of our electrical needs.

It is exceedingly clear that the electric power industry cannot continue to grow at its present rate for much longer. Our natural resources are finite; we have a limited amount of land, water, and air to serve all of the demands that society places on them. Electric power cannot claim all of these resources. In fact it must be limited to a small percent of them if we are to be able to enjoy the many benefits of electric power.

The Lake Michigan Enforcement Conference must set up a committee to investigate ways of using electrical power more efficiently. We shall mention some suggestions shortly. As these ideas are developed they must be made known to the general public so they can be put into practice. Most of the agencies represented here have done a very poor job of public relations. In fact, the average citizen has probably never heard of them. This must change as people cannot use the information they do not have. Some of our ideas are as follows:

For the present, ban the use of electricity for all heating purposes where gas or oil would be more efficient. It makes no sense to burn gas to produce electricity which in turn is used to heat a home when the same thing could be accomplished using one-third of the gas directly. It has been said that the only less efficient way of heating one's home than electricity was to burn it down. Building codes should be changed to encourage increased use of insulation and natural light, heating and cooling. Once again it makes no sense to build buildings which have to be lighted, heated, and cooled, no matter what time of day or year.

Promotional practices and rate structures have to be changed to discourage the wasteful use of electricity. Consumers must be informed of the efficiency of all appliances, especially the large ones. There are more ideas but the point is clear. Our proposed solutions to the thermal problem attempt to get at the roots of the problem because only in this way can a long-term solution be fashioned. We propose surgery not cosmetics.

In closing, we would like to paraphrase the late Senator Robert Kennedy when he said that some people look at things as they are and say why, but we look at things the way they could be and say why not. We hope you see it the same way and will set up the necessary machinery to get some of these ideas going.

Thank you.

And I have one short further comment, as I just got the report of the Federal EPA in the mail yesterday and I didn't have time to include it in my statement. But I would like to point out a gross inconsistency among some of the Federal administrators, and you can see what I mean.

This refers to the speech that -- I think it is John R. Quarles made to the Edison Electric Institute Eighth Biennial Financial Conference. And in it he said: "I wish to state my opinion that the future vitality of our country demands continued large growth of the electric power industry." And he goes on to say how this electricity is going to be needed for mass transit and pollution control devices.

Well, much work has been done by Professor Levinson at Berkeley, and he finds that the increased electrical consumption due to many of these devices will add a small percentage to our electrical needs. In light of what I have said in my main paper, I think that the statement of Mr. Quarles with the statements of Mr. Ruckelshaus, when he indicates that he doesn't want the heat to go into the lake, the effect is this: Unless we do something about the growth of the electric power industry, we are going to be producing more and more heat, and it has got to go somewhere, and whether it goes into the lake or not, or into the streets, it doesn't make any difference. There is going to be a real problem.

Thank you.

MR. MAYO: Thank you, Mr. Carter.

Are there any questions, gentlemen?

Thank you again, Mr. Carter.

MR. BLASER: The next witness for Illinois is Mrs. Eileen Johnston. She wants only 2 minutes.

STATEMENT OF MRS. EILEEN L. JOHNSTON, WILMETTE, ILLINOIS

MRS. JOHNSTON: I just want to state that I am so proud of this young man who just spoke. I have been very close to the Northwestern Students for a Better Environment, and I come up before you gentlemen very humbly, following in his footsteps here, and I appreciate the opportunity.

You know me well enough to know that I have no technical background, but I have a great deal of concern. I am real happy to see all of you gentlemen finally. It did take a lot of letter-writing on the part of a lot of citizens, and quite a bit of needling to get this conference together, and now that you are all here I am most appreciative.

You know yesterday it occurred to me that probably the reason it was so long overdue was that Carlos Fetterolf was down in Washington writing his bluebook, and, of course, we couldn't have a conference without Carlos. (Laughter)

MR. FETTEROLF: Thank you.

MRS. JOHNSTON: And I also want to admit to you in public that last year I made a mistake, and thanks to Dr. Fred Lee -- a man that I respect a great deal -- I want to apologize. I quoted a man, a professor at the University of Minnesota by the name of Hoover, and I find that I really shouldn't have quoted this gentleman. So I am sorry.

Now, as far as the thermal pollution position -- I mean thermal problem -- all I want to say is that I still have confidence in the Illinois position taken at the last conference. I heard all of the testimony -- and these gentlemen heard it -- and I realize why they made the statement.

Now I must admit I am a little bit sneaky because my other comments are not on thermal, but that gentleman from Illinois at the end of the table said I could be sneaky. So, if Mr. Mayo doesn't stop me, I just want to go on here a little bit about a couple of things that concern me.

I urge the consideration of the use of ozonation instead of chlorination, in sewage treatment, and there are several advantages of the ozone use:

1. Onsite generation eliminates the hazard of transporting and handling large amounts of chlorine.

2. Tests have shown that ozone destroys both bacteria and viruses; chlorine is ineffective against viruses. And this information came from Environmental Science and Technology.

3. Also ozone is more effective against the major

taste- and odor-causing compounds in raw water.

4. Then, in November 3, 1971, Chemical Week, they quote Clayton Wynne, Project Director of Airco: "A 1-year trial at the Blue Plains treatment plant showed that 'ozone is as economical as any available tertiary treatment step.'"

Three-quarters cent per 1,000 gallons does not seem costly to me if it kills off viruses.

And now here I am going again quoting people, but the Illinois Lake Michigan and Adjoining Land Study Commission felt that these were competent men, so I feel that I may quote them also.

Dr. Joseph L. Melnick of Baylor University College of Medicine said at a hearing before this Commission: "It appears to me that as our population increases and the reuse of water supply becomes more and more necessary, we must increase our efforts to solve this problem of viruses in water. We should monitor sewage and water treatment plants effectively, so that the citizens of this Nation can be assured that the viruses that are present in the sewage and surface waters are completely removed before water is redistributed for human use."

I think the time has come when standards should be set of maximum allowable virus contamination of water. It is astonishing to me that over all the years during which I have been engaged in this work, that there hasn't been a single government agency that has even considered setting such standards. So I ask you gentlemen to consider that.

At the same hearing, Dr. Frederich Deinhardt of Rush Presbyterian St. Luke's Medical Center, Chicago, stated: "It seems to me that a reasonable approach would be 1) to stick to the established procedures; and 2) to establish as quickly as possible more detailed studies on the detection of viruses in our waters and on the removal of viruses in various waters, sewage and others. Once we have these data we can think about setting new standards and change in our procedures."

And I am sure you are familiar with the pilot study in Louisville, Kentucky at the sewage treatment plant, and I believe they had positive results. I have detailed information on this.

And so I urge the conferees to make a study of this method and to consider regulation of viruses in water and I will do the same before the Illinois Water Pollution Control Board when I make a statement before them.

I do realize that the Phosphorus Committee has gone into the sedimentation problem, but with the seriousness of this growing problem I believe that it warrants continued in-depth study with a special technical group, and I would hope that you might set one up as a steering technical committee.

One respected scientist I have recently talked with feels that his research indicates that nitrogen is the controlling nutrient. So, in spite of the excellent research we heard yesterday -- I mean Tuesday -- do we really have the answer?

It is very obvious to me that the Four-State Conference must continue. We have many unsolved problems, much on-going research to consider. The conference keeps everyone on his toes, everyone works diligently to prepare for it. It is truly the only way citizens can keep pace with progress being made on the restoration of the water quality of our huge well of the four States, Lake Michigan. My only comment there is that I wish the citizens would come and attend these conferences.

I urge you conferees to set a date for the next conference before you leave.

I thank you for your good work. I think you are highly competent men and I appreciate what you are doing.

MR. MAYO: Thank you, Mrs. Johnston.

At least in terms of a partial response to your commentary on viruses, essentially that same question was put to EPA by a member of the Illinois Water Pollution Control Board some few months ago.

We can, I think, introduce a copy of that letter and our response into the record in order to have at least a partial reply to your point in the record.

As I recall, the essence of our response was that we, along with many, many other people, recognize the seriousness of the presence of viruses in wastewater effluents and in our streams. We are aware that there are some fairly exotic techniques for identifying viruses in water, and we are aware of the need to establish standards for viruses. But we are faced with a very serious major problem of not having a sampling and analytical technology that can be generally used in a fairly ordinary laboratory. There are rather sophisticated components of analytical equipment involved, and very large quantities of water are needed for sampling purposes.

So, as a consequence, we are working on the technology to try to develop a much more reasonable or much more easily applied capability for virus detection and analysis, as one of the building blocks on which the establishment of a standard could be based.

MR. BRYSON: One additional comment, Mr. Mayo.

Eileen, we have under way at the National Quality

Laboratory at Duluth some research into ozonation. The results are not in yet but work is under way.

(The documents referred to by Mr. Mayo previously follow in their entirety.)

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U.S. Environmental Protection Agency
1 North Wacker Drive
Chicago, Illinois 60606

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February 18, 1972

Mr. Jacob D. Dumelle
Illinois Pollution Control Board
189 W. Madison Street, Suite 900
Chicago, Illinois 60602

Dear Mr. Dumelle:

We agree with you on the desirability of establishing a virus standard for water. We have not recommended standards for viruses because the technology for virus identification and enumeration has not advanced to the degree where routine employment of the techniques is possible. The status of waste treatment technology with respect to virus control or removal has also been a consideration.

We realize that virus identification, enumeration and control methods are under intensive study by workers in all quarters and that quite promising research data has been published. The enclosed "Proceedings of the Thirteenth Water Quality Conference - Virus and Water Quality Occurrence and Control," recently held in Illinois, is an excellent compilation of some of this research. However, in view of the uncertain correlation of virus occurrence with coliform counts or other indicators, and the lack of adequate monitoring techniques, we cannot at the present time establish scientifically defensible criteria for viruses in water.

We would be pleased to participate in any hearing process the Board may wish to conduct in considering the detection and treatment of viruses.

With respect to the Water Quality Criteria draft revision, we will make the draft available to you as soon as it is cleared for printing.

Be assured that our Agency will continue intensive research on water borne viruses and will move to establish standards as soon as feasible.

Sincerely yours,

Francis T. Mayo
Regional Administrator

F.T.M.

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STATE OF ILLINOIS
POLLUTION CONTROL BOARD
189 WEST MADISON STREET SUITE 900
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November 2, 1971

Mr. Francis T. Mayo
Regional Director
Environmental Protection Agency
One North Wacker Drive
Chicago, Illinois 60606

Dear Mr. Mayo:

On October 29 I wrote to you regarding the possibility of your suggesting a virus standard to us as part of our Water Quality Standards Revision hearings (R71-14).

I forgot to ask if it would be possible for us to obtain the drafts of the new edition of the Water Quality Criteria Report (the "green book") which we have been told will be ready about January 1, 1972.

Since we have now completed hearings on the proposed revision to the Illinois water quality standards we are ready to revise the initial draft in the light of testimony received and latest scientific findings. Because the new edition will contain the latest scientific opinion on water quality criteria we would like to have access to it as soon as possible and without waiting for the inevitable delay for printing purposes.

Please let us know when we might expect to be able to examine a draft copy of the second edition of the Water Quality Criteria report.

Very truly yours,

Jacob D. Dumelle

Jacob D. Dumelle
Member

JDD:rj
cc: Board Members
Mr. Michael Schneiderman
Mr. William Blaser

State of Illinois
Pollution Control Board
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David P. Currie, Chairman
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October 29, 1971

Mr. Francis T. Mayo
Regional Director
Environmental Protection Agency
Region V
One North Wacker Drive
Chicago, Illinois 60606

Dear Mr. Mayo:

As you know the Illinois Pollution Control Board has in process a massive revision of its water quality standards, termed R71-14 by our numbering system.

Mr. Chris Potos of your staff testified and generally endorsed the proposed revisions on June 17, 1971 at the Evanston hearing.

We have since recently received the Report to the Governor and the 77th General Assembly of the Illinois Lake Michigan and Adjoining Land Study Commission (the "Mann Commission").

The report (on p. 24 in Volume I) recommends an intensive study of the dangers of viral contamination of Illinois waterways and "the effectiveness of existing waste and water treatment facilities in eliminating this menace".

My own feeling is that viruses will undoubtedly be found in Illinois waters to which sewage is discharged since chlorination is known to be relatively ineffective in achieving virus kills. So I think any such study will certainly find viruses in Illinois streams.

The question I would put to you is "What should we do about viruses?" Is the Federal government presently developing virus standard for recreational and drinking water supplies? Dr. Joseph L. Melnick, a virologist from Baylor College of Medicine is quoted in the mmission reports (p. 109, Vol. II) as follows:

> "I think the time has come when standards should be set of maximum allowable virus contamination of water. It is astonishing to me that over all the years during which I have been engaged in this work, that there hasn't been a single government agency that has even considered setting such standards. It is a question which has been ignored."

Dr. Melnick goes on to suggest that his virus detection equipment be developed for use as virus removal equipment.

Would you at this time suggest we incorporate a proposed virus standard in our water quality standards revision? It seems to me a standard is desirable even though the technology may not be available. If viruses are indeed a hazard then we ought to post a limit for their concentration. Any suggested number you can furnish us, hopefully backed by scientific study, would be appreciated.

Sincerely yours,

Jacob D Dumelle

Jacob D. Dumelle
Member

JDD:rj

cc: Board Members
Mr. Michael Schneiderman
Mr. William Blaser
Dr. William Ackermann

MR. MAYO: Mr. Blaser.

MR. BLASER: Before we proceed with the next witness, Mr. McDonald asked us some questions about monitoring -- thermal monitoring as far as Zion is concerned. We had some thoughts on it, but we needed verification.

Mr. Blomgren will address himself to that.

MR. BLOMGREN: Mr. McDonald, the original proposal for study at the Waukegan and Zion sites, and the monitoring activities came from the original thermal committee from the Four State Conference where indeed we recommended certain monitoring programs, and that is the program we recommended to Commonwealth Edison, and they started from and have indeed expanded on it.

One of the witnesses from Commonwealth Edison tonight will indicate the study program. They are both working on one -- the Waukegan and the Zion study.

MR. BLASER: The next witness we have is Mr. Daniel Feldman from the firm of Isham, Lincoln and Beale.

Mr. Feldman.

MR. FELDMAN: Mr. Mayo, as you know, I am not a witness at these things, because I am not qualified. I am just going to call the sequence of the witnesses.

If you are thinking about breaking for dinner, I would ask that you let us get through the first two, because